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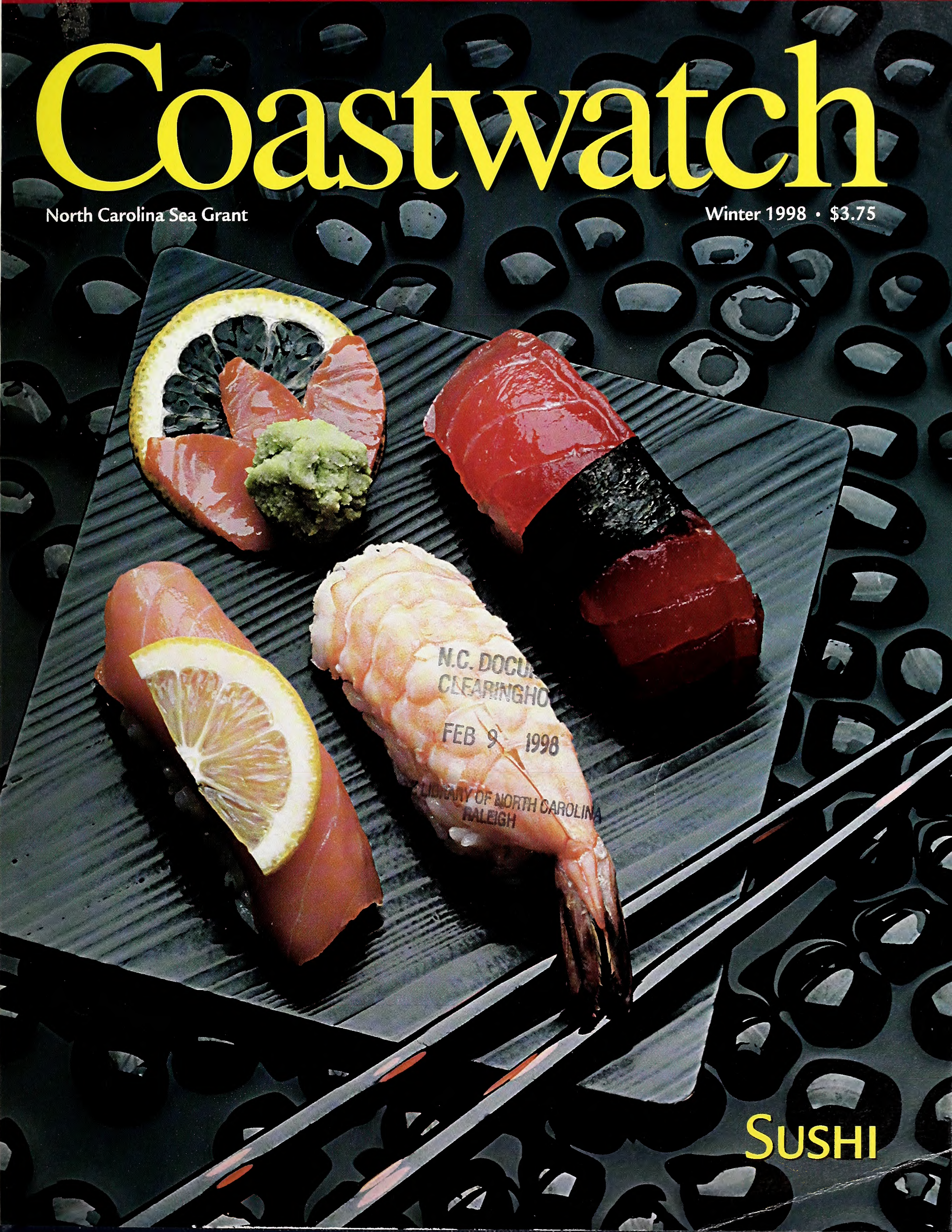
Art in Schools • Tryon's Kitchen Garden • SandyDuck '97

Coastwatch

North Carolina Sea Grant

Winter 1998 • $3.75



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SUSHI

From the Editors

Conclusions and Resolutions

The New Year is traditionally a time of endings and beginnings, conclusions and resolutions. At *Coastwatch*, that has never been truer than now.

We start the year with the loss of Kathy Hart, managing editor of the magazine since 1984. Hart has moved on to new career challenges, but not without leaving behind a couple of articles. She offers advice about wintertime tackle care and heart-smart ways of cooking the fisher's catch.

Hart also left *Coastwatch* readers a parting gift. In the next issue, we'll begin a six-part series by free-lance writer Eddie Nickens about coastal landmarks, places such as "The Hook" from which coastal cultures have emerged. We'll run four of his articles this year and two next year.

This issue, Daun Daemon kicks off the year with a guide to sushi — everything from its ancient origins to contemporary etiquette for eating it.

Free-lance writer Brooks Preik takes you into the schools with an innovative program from St. John's Museum of Art in Wilmington. "Art in the Schools" introduces youngsters to art, mixing in a little history, social studies, geometry and creative writing along the way.

David Cecelski digs into the history of the kitchen garden at Tryon Palace. You might be surprised by the unusual vegetables and herbs that grew in colonial gardens and graced dinner tables of the era. Cecelski takes you there with his usual flair for bringing to life historical detail.

Finally, we'd like to make a resolution, although the season for that may be a few weeks old. As *Coastwatch* goes through changes in format and staff, we resolve to continue to make the magazine as interesting and responsive to our readers as possible.

We'd love to hear from you this year!

Jeannie Norris

Daun Daemon

Contributors

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Elizabeth Burke • David Cecelski • Daun Daemon • Kathy Hart • Jeannie Faris Norris • Brooks Preik

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Coastwatch

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After 18 years at Sea Grant, Kathy Hart has left her mark on more than *Coastwatch*. She was a communications leader in North Carolina and the nation. Hart's recent departure was felt throughout the national Sea Grant network. 32

Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is interim director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for $15 by the North Carolina Sea Grant College Program, Box 8605, North Carolina State University, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: faris @unity.ncsu.edu or ddaemon@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of sushi.

Table of contents photo of "Mending Nets: Noonday Glare," a serigraph by Claude Howell.

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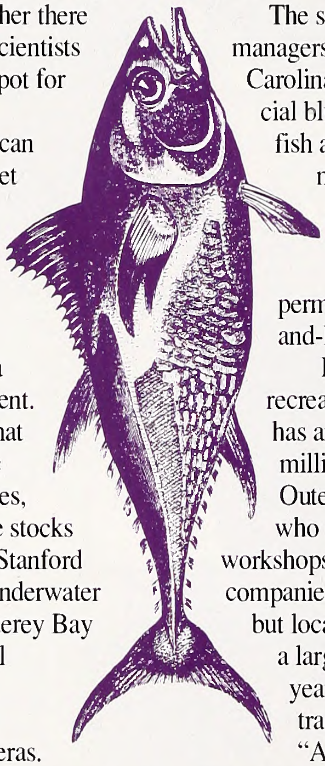
COASTAL
TIDINGS

Studying Bluefin Tuna



Recreational fishers know that the waters off Cape Hatteras are a hot spot for bluefin tuna, which gather there from January till March. Scientists now see the area as a hot spot for research on the migratory patterns of the fish, which can live 30 years, exceed 10 feet in length and weigh up to 1,200 pounds. "Scientists are cxcited because the fish are here in such high numbers," says Jim Bahen, North Carolina Sea Grant marine extension agent.

Researchers believe that bluefin tuna in the Atlantic are divided into two families, but they do not know if the stocks intermingle. A team from Stanford University, the National Underwater Research Center, the Monterey Bay Aquarium and the National Marine Fisheries Service recently began studying bluefin tuna off Cape Hatteras. Local charter boats and many recreational big-game anglers cooperated with the team and helped tag and release over 3,000 tuna in the 1996 season.

The study's results may help managers decide whether North Carolina should establish a commercial bluefin fishery. Because the fish are so valuable — bringing as much as $30 a pound — strict regulations aim to keep stocks healthy. Currently, the federal government permits only recreational hook-and-line fishing for bluefin.

Preliminary figures show that recreational bluefin tuna fishing has an annual $30 million to $40 million economic impact for Outer Banks towns, says Bahen, who organizes bluefin tuna workshops. Not only do charter boat companies reap the benefits, he notes, but local restaurants and hotels turn a large profit during a time of year when business was traditionally slow. Says Bahen, "A sleepy village on the Outer Banks has now become a world-class fishing spot." ◘

In the Next Issue of *Coastwatch*

At certain places on the North Carolina coast, history, culture, natural beauty and lore meet to transcend mere geography. Starting in the next issue of *Coastwatch*, a new series on these coastal landmarks, written by Eddie Nickens and photographed by Scott Taylor, shows the soul of the North Carolina coast. The first stop is at "The Hook," the sandy spit of Cape Lookout where humans and nature often seem at odds. Whaling history, fly-fishing, the birth of a national park, working a long-haul net – you'll cover it all. Future excursions will take you to "The Ditch" (the Intracoastal Waterway), "The Point" (Cape Hatteras), "The Stream" (the Gulf Stream), "The Inlet" (Oregon Inlet) and "The Reef" (alongside the Outer Banks).

Also in the next issue, Odile Fredericks explains how the Coastal Waters Heritage Tourism Council works to boost boating tourism with water trails to historic and cultural sites along the coast. In another article, Fredericks looks at a new state law that will allow coastal towns to build over public waters along their historic waterfronts. ◘

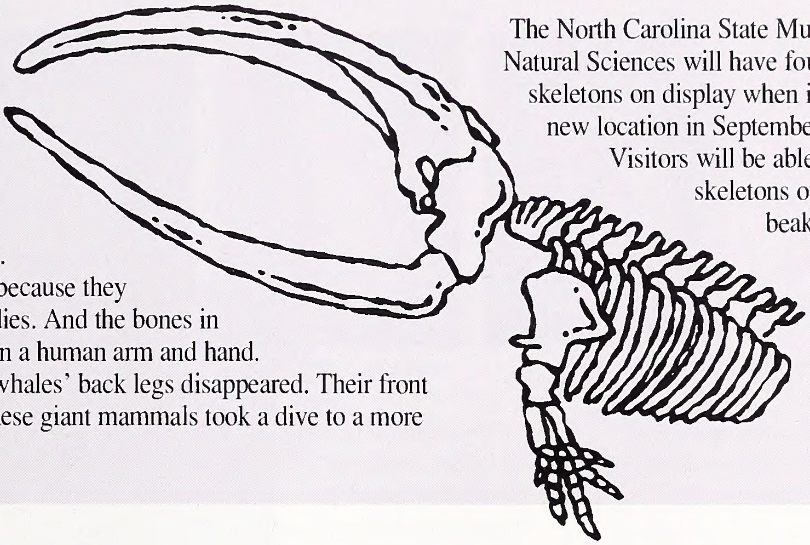
COASTAL
TIDINGS

When Whales Walked

Whales have been around for millions of years, but they haven't always called the ocean home. When dinosaurs lived on Earth, whales walked on land. They had four legs and probably walked like alligators.

We know whales walked because they still have leg bones in their bodies. And the bones in their flippers match the bones in a human arm and hand.

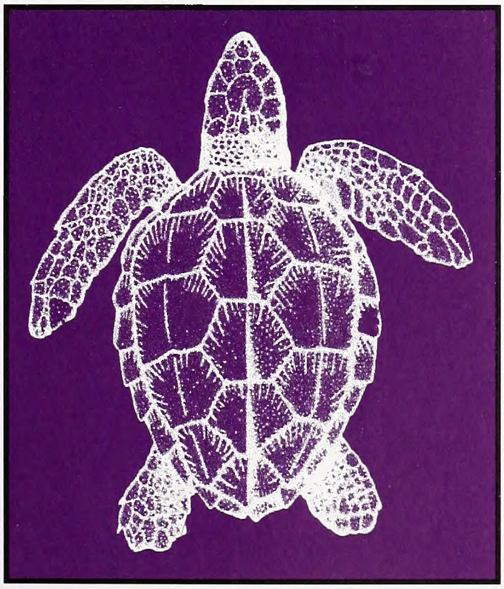
Over thousands of years, whales' back legs disappeared. Their front legs changed to flippers, and these giant mammals took a dive to a more watery environment.



The North Carolina State Museum of Natural Sciences will have four whale skeletons on display when it opens its new location in September 1999.

Visitors will be able to see the skeletons of the True's beaked whale, fin whale, sperm whale and right whale. ▣

Sea Turtle Strandings Down



Sea turtle strandings along the North Carolina coast were down 25 percent in 1997 compared to the previous year, but preliminary data suggest that nesting was low, according to Ruth Boettcher, N.C. Sea Turtle Project coordinator. Through mid-November, 353 strandings were reported; 471 turtles stranded during the same period in 1996.

Most strandings occurred in Dare (113) and Carteret (110) counties, probably because they have the longest shorelines, Boettcher says. Brunswick County had 52 strandings. Most of the stranded turtles were loggerheads, which find the North Carolina shore attractive for nesting.

Preliminary nesting data for 1997 showed 560 nests for the year, which is on the low end of the normal range, according to Boettcher.

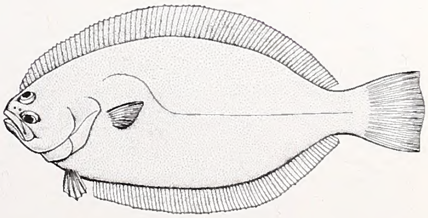
"Because of cooler temperatures in May and June, the nesting season was slow to start. It picked up at the end of June and in July," Boettcher says. "The early-laid nests will probably have lower success because, for one thing, the incubation periods were longer than normal."

She anticipates that data will show the hatch rates improved for July and August. ▣

Seafood Availability Chart

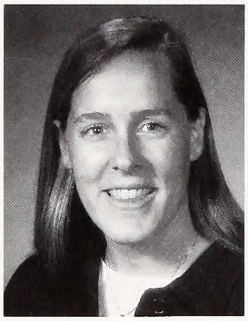
You're standing in the supermarket, staring at the seafood counter and wondering what's the best catch for dinner. You'd like something fresh off the boat, but you don't have a clue what's in season.

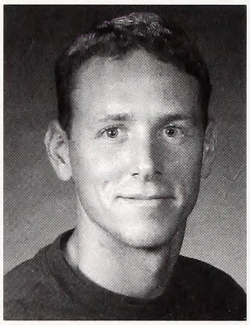
Wonder no more. North Carolina Sea Grant has a seafood availability chart that graphically depicts the seasonality of 24 species of fish and shellfish commonly harvested in Tar Heel waters. Learn that soft crabs are most abundant in May, flounder in October and shrimp in July and August. The 11- by 34-inch poster will help you make the best decisions about bringing home the freshest catch. For ordering information, call North Carolina Sea Grant at 919/515-2454. ▣



COASTAL TIDINGS

Three North Carolina Students Win Prestigious Knauss Fellowships


Katherine Colborn


Matthew Kendall

Kristopher Pickler

Herman Lankford (3)

Three graduate students from North Carolina are heading for Washington, D.C., after being selected for the 1998 Dean John A. Knauss Fellowship program. Created in 1979, the program offers a unique educational experience to students with an interest in marine, ocean and Great Lakes resources and in the national policy decisions affecting those resources.

The program is sponsored by the National Sea Grant College Program and matches highly qualified graduate students with hosts in the legislative branch, executive branch or appropriate associations in the nation's capital for a one-year paid fellowship.

North Carolina's recipients are Katherine Colborn, Matthew Kendall and Kristopher Pickler.

- Colborn is a second-year student at Duke University's Nicholas School of the Environment. Her master's project at Duke examines how commercial touring operations that feed wild bottlenose dolphins along the Southeast coast affect the animals' behavior. She has experience as an advocate, educator and policy coordinator. She has been assigned to the executive branch for her fellowship.
- Kendall is completing his graduate study in reproductive ecology at North Carolina State University's Department of Marine, Earth and Atmospheric Sciences. His master's project examines the practice of harvesting large male blue crabs and how that affects the population's reproductive potential. This work could have practical implications on an industry valuable to the mid-Atlantic. He has been assigned to the executive branch for his fellowship.
- Pickler is completing his graduate study at Duke University's Nicholas School of the Environment. His master's project compares North Carolina's policies of hardening and stabilizing its estuarine and ocean shoreline. Recently, Pickler worked as an intern at North Carolina Sea Grant researching and analyzing the state's public trust doctrine (policies that determine public and private rights to submerged land and overlying waters). Pickler was assigned to the legislative branch for his fellowship. ◘

Specialists in Tourism and Seafood Join Sea Grant

Tourism and seafood are linchpins in the economic well-being of the North Carolina coast. Two new extension specialists with North Carolina Sea Grant will work to encourage a thriving tourism industry and safer seafood for us all.

Jack Thigpen, the coastal recreation and tourism area specialist in Manteo, will handle tourism and the emerging field of ecotourism. Barry Nash, the extension seafood safety specialist in Morehead City, will cover seafood with an emphasis on industry compliance with new federal safety regulations.

Thigpen will orchestrate research and supply information to help coastal communities and the tourism industry better plan for visitors. This issue is critical to North Carolina as its coast grows more popular as a tourist destination. Thigpen holds doctorate and master's degrees with emphases on natural resources and rural development. For nearly a decade, he has worked with the Texas Agricultural Extension Service developing programs to train community leaders, businesses and extension faculty in creating a sustainable natural and economic environment.

Nash will focus on seafood safety and processing. This is a critical issue to the seafood processing industry as it works to comply with new federal regulations aimed at reducing and preventing health hazards and contamination in fishery products. Called HACCP (Hazard Analysis and Critical Control Points), this program took effect Dec. 18. Nash has a master's degree in food science. His 12 years of experience in the food industry includes seafood-related work.

Look for more about Thigpen and Nash in upcoming issues of *Coastwatch*. ◘

Learning From Hurricane Fran

When Hurricane Fran hit North Carolina's southern beaches in September 1996, intense winds and storm surges changed the face of the barrier islands and inlets and destroyed many homes and businesses. A new scientific understanding of coastal processes and an increased focus on management and policy are positive legacies of the storm and will provide guidance for how we live on barrier islands in the future.

Last year, two special episodes of UNC-TV's science series *I.Q.* explained Hurricane Fran's impacts and the knowledge gained in the storm's aftermath. Now, UNC-TV and North Carolina Sea Grant have developed educational videos based on the programs along with a curriculum booklet, *Barrier Islands and Hurricane Fran: An Educational Guide for the UNC-TV Videos* Hurricane Fran: The Science Behind the Storm *and* Hurricane Fran: Lessons Learned. Written by Lundie Spence, Sea Grant's coastal education specialist, and Sandy Burk, an education consultant, the guide offers activities, resources and more.

The N.C. Division of Coastal Management has provided funding to distribute free hurricane curriculum packets to coastal educators and decision-makers. However, a limited number are available to the general public. Packets include the two 26-minute videos, the guide, a WTVD-11 hurricane tracking guide and a reprint of the January/February 1997 *Coastwatch* article "After the Storm: How Hurricanes Reshape Beaches and Building Standards."

The packet costs $20, including postage and handling. To order, send your check, made out to N.C. Sea Grant, to North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605.

NOAA Recognizes Coastal Heroes

Kristopher Pickler, a North Carolina student and Knauss Fellowship recipient, has been lauded as a national coastal hero.

The Walter B. Jones and NOAA Excellence Awards of Coastal and Resource Management recognize people and organizations whose hard work and dedication are vital to solving the nation's coastal problems.

Pickler, a student at Duke University's Nicholas School of the Environment, was one of four students nationwide recognized as an outstanding student of coastal and marine graduate study. He received the award in part for his work at North Carolina Sea Grant with legal specialist Walter Clark on a research project examining the state's public trust conflicts. His experience, coupled with work for South Carolina's coastal management program, has given him firsthand familiarity with the environmental and human elements of coastal issues.

The award is named for Congressman Jones, who represents District 3 in North Carolina. Jones has served on the House Merchant Marine and Fisheries Committee and has worked on coastal legislation for many years.

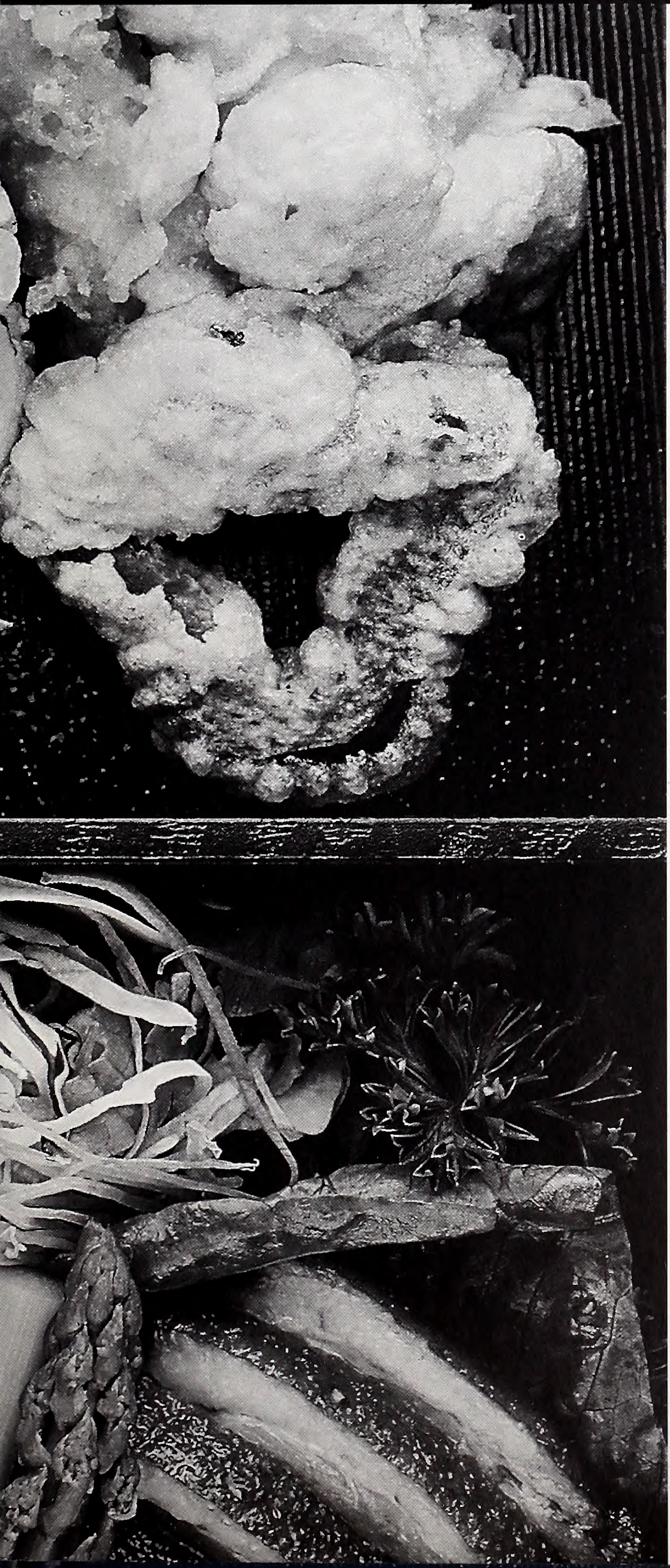
Total Landings Increased in 1997

Fishers who net menhaden, king mackerel and sea mullet pulled in more fish in the first half of 1997 than in the same period of 1996. Preliminary data from the N.C. Division of Marine Fisheries indicate that landings of many species were up from January to June. Shellfish landings overall showed no marked change, and some species – such as summer flounder – declined. Figures below are in pounds.

Species	**1996**	**1997**
• *Atlantic herring:*	526,770	100,372
• *clams:*	421,058	329,709
• *croaker:*	5,645,213	6,970,877
• *dogfish shark:*	9,669,096	6,876,963
• *king mackerel:*	304,272	816,062
• *menhaden:*	7,523,813	30,414,063
• *oysters:*	105,290	117,272
• *sea mullet:*	219,349	580,859
• *southern flounder:*	355,768	552,966
• *summer flounder:*	4,202,995	1,471,917

The Raw Facts About

SUSHI



By Daun Daemon

Say "sushi" to most Americans and enjoy the contorted expressions and odd noises the word elicits. People who will eat steak tartare or grill their burgers with a bloody middle feign gagging at the mention of a small cut of raw fish.

But a growing number of Westerners are discovering these Eastern delicacies, which have been staple food in Japan for centuries. Why are more and more people willing to eat their seafood in the raw? One possible answer is that many pieces of sushi are not raw, but rather cooked, smoked or marinated.

Still, most folks who eat at sushi bars will try a raw cut or two, possibly because the food's beauty is so enticing. When arrayed on a platter and served with artful garnishes, the nuggets of fish and rice look for all the world like an offering of precious jewels in glistening hues of topaz, ruby and pearly white.

To many, the cost for this finger food puts it in the same luxury category as gemstones. At about $3 to $4 for a two-piece serving, a meal for one person can cost $30. The high price coupled with the exotic flair may be one reason sushi has caught on as a "yuppie" food.

But a true connoisseur, a *sushi tsu*, will tell you the real reason he eats sushi is indefinable. It's both a taste and dining experience, a challenge to pick the freshest catch that day and a spirited communion with the chef at the bar.

This fascination with bite-sized bundles of rice and fish all started centuries ago with a little fermentation.

WHERE DID SUSHI COME FROM?

Most sources agree that what we know today as sushi originated as a way to preserve fish. According to the *Illustrated Encyclopedia of Japan*, the method actually arose in ancient China. Salted fish (usually carp) packed in rice was fermented for up to a year before the rice was thrown away and the fish served.

Eventually the pickling process crossed the waters to Japan, where it was modified through time. By the 1800s, chefs began to use vinegar to approximate the fermented flavor and cut the preparation time substantially. The rice was then found appetizing enough to eat with the fish.

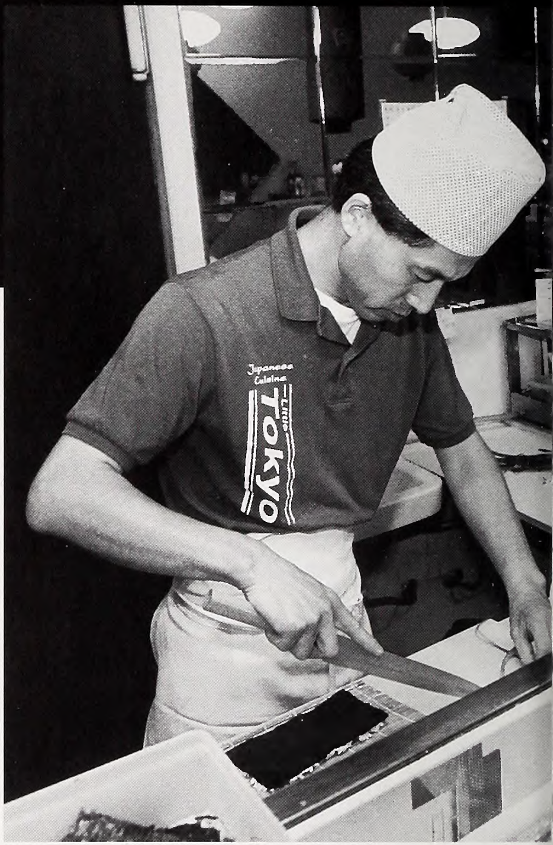
Also around this time, the forerunners of today's sushi bars began to pop up in Japan's large cities: street stalls that offered sushi as snack fare to passers-by.

And different parts of the country developed different sushi styles. The type best known to American aficionados — *nigirizushi* — arose in Edo, the city now called Tokyo. Equally popular in Japan is *oshizushi*, a form developed in the country's financial capital, Osaka.

Continued

Lisa Christensen (3)

Little Tokyo's Ron Takahashi...



slicing the fish...

SUSHI VOCABULARY

- *sashimi* — slices of raw fish
- *sushi* — vinegared rice topped with fish or other topping
- *nigirizushi* — hand-sculpted fingers of rice topped with fish, roe, egg, etc.
- *oshizushi* — rice pressed into a mold, topped with marinated fish, unmolded and cut into bite-sized pieces
- *makizushi* — rice and toppings rolled log-style in seaweed and cut into pieces
- *uramaki* — *makizushi* rolled with the rice instead of the seaweed on the outside
- *temakizushi* — rice and toppings rolled by hand into a cone of seaweed
- *chirashizushi* — known as "scattered sushi," a variety of toppings served over or mixed into rice
- *shari* — rice with seasoned vinegar
- *su* — rice vinegar
- *sushi su* — seasoned rice vinegar
- *tane* — topping and filling ingredients for all styles of sushi
- *nori* — seaweed
- *wasabi* — Japanese horseradish
- *gari* — pickled ginger
- *shoyu* — soy sauce
- *sushi tsu* — a person knowledgeable about sushi
- *itamae* — the sushi chef
- *hashi* — Japanese chopsticks
- *Kanpai* — "to your health" ▣

The result is today's diversity of sushi styles and ingredients. The toppings, called *tane*, range from fish to egg omelet, vegetables to roe. The fish perched atop the rice can be uncooked, boiled, broiled, steamed, grilled, pickled, fried or dried. And there's even the seemingly contradictory vegetarian sushi: strips of vegetables rolled in seaweed and served with the same flair as the traditional type.

HOW DOES A SUSHI CHEF LEARN HIS TRADE?

Little Tokyo in Cary is a typical American sushi restaurant, with the bar tucked in back of the dining room. In Japan, the sushi bars are generally sheltered from the cooked food smells of the main dining area and set off in a room to themselves.

Decorated with mirrors, Little Tokyo is smaller than it first appears, but

and serving a platter of sushi gems.

that too is typical of sushi restaurants. Because of the personal attention the chef gives his customers, the bars seat only a handful of people.

And the chef is the star attraction. He is often the reason hungry patrons will wait in line for a seat at the bar rather than take the first available table.

Ron Takahashi, executive chef at Little Tokyo, works quickly and efficiently, all the while smiling and keeping up conversation with the folks gathered round to watch his skillful preparation.

In Japan, the sushi chef begins as a young apprentice who does nothing more than carry food out to customers. Eventually he is allowed to make rice but continues to observe the master chef at work. In time, as an assistant, he will learn to cut the fish himself and then one day become licensed to open his own shop.

Takahashi says that process takes about five years to complete because it involves no formal instruction. "In Japan, no teaching, just watching," he says.

He explains that in the United States, a would-be sushi chef can become proficient in under a year because he does not have to learn how to judge the catch. "With fresh fish, you need more experience. One to two years is not enough," he says.

A typical sushi chef in Japan will rise early in the morning, visit the fish market and purchase his day's selection from catch brought in directly from the sea. He needs the ability to assess the fish at a glance, to determine its quality and freshness before taking it back to his shop.

In the United States, the fish in most restaurants does not come fresh from the sea. The fish Takahashi serves has first been bought by an importer, who in turn sells the product to a wholesaler. Takahashi receives a shipment from the wholesaler every two weeks, and he thaws the fish and other products as he needs them.

HOW IS SUSHI PREPARED?

Though the Japanese prepare raw fish in numerous ways, Americans are most familiar with three basic forms: *sashimi*, *nigirizushi* and *makizushi*.

Sashimi is simply cuts of raw fish served with rice. What makes or breaks *sashimi* is how the fish is cut. Different types of fish require different treatment to enhance their flavor and texture. Many species can be cut in rectangular slices about three-eighths inch thick. Seafood with thin body walls, like squid, is cut into strips about 2 inches long and one-sixteenth inch thick. The meat of thick-fleshed fish is cubed, while firm, white-fleshed fish are cut into wafer-thin slices.

Nigirizushi is made by hand-molding a finger of rice, topping it with a dab of *wasabi* and then a piece of fish or other topping. Some pieces are then wrapped with a ring of seaweed.

Continued

IS SUSHI GOOD FOR ME?

Takahashi believes that many people eat sushi because they consider it a healthful food. And even though consuming raw seafood carries some risks (see page 11), the benefits are many.

"Sushi is virtually fat free, and an entire six pieces from a roll has less than 30 calories," says Claudia Plaisted, director of the Medical Nutrition Curriculum Initiative in the UNC-Chapel Hill School of Public Health. "It's incredibly high fiber, low fat and rich in minerals. And there's the additional nutritional benefit of those fatty fish oils, especially in the salmon."

Plaisted points out the low incidence of most chronic diseases in the Japanese people, who eat a diet consisting mainly of fish and rice. They generally have lower rates of many cancers, heart disease and diabetes. But, she says, they have a very high rate of stomach cancer because of the many salted and pickled foods they consume. If you eat sushi frequently, Plaisted recommends that you apply soy sauce sparingly or use the low-sodium kind.

The only complaint she hears about sushi is that some people who eat too much at one sitting may suffer discomfort.

"Seaweed is very high in fiber so that if you don't have a high-fiber diet, you could get gastrointestinal distress," she says. "The signal is not to give up sushi but to eat more fiber in your diet."

Makizushi, or sushi roll, is made using a bamboo mat. A sheet of seaweed is placed on the mat and covered with rice. Toppings are placed lengthwise near one end, and, using the mat as a guide, the seaweed and rice are rolled over the topping and into a log, which is usually cut into six pieces.

Part of the cuisine's appeal is the chewy, glossy rice. Making sushi rice is similar to making regular rice, with three exceptions: the process begins with hot rather than cold water, the rice is cooked with a little less water than is normally required, and it is quick-cooled while being tossed with a wooden paddle in a shallow wooden tub or bowl. Some chefs, like Takahashi, use rice cookers.

Shaping the rice requires a deft touch as the grains are not forced into a wad but rather gently pressed together so that they just adhere to one other. For some highly skilled chefs, the goal is to have all the grains of rice run in one direction.

FINGERS OR CHOPSTICKS?

Tempted by the beauty and nutritional value of sushi, neophytes may find the manner of eating it daunting. Surreptitious glances around the bar will help, but they probably won't give you all the points of etiquette you need. So, for those of inquisitive palate but hesitant hands, below are some guidelines.

Chopsticks

Chopsticks usually arrive wrapped in paper and joined at the large end to show that they have not been used. Some people vigorously rub their chopsticks together, ostensibly to remove splinters. However, in Japan this is considered coarse and unnecessary, as it actually raises smaller splinters.

If you put your chopsticks down between bites, lay them in front of you parallel to the table or counter edge, not at the side of your place as you would knives and forks.

If you share a platter of sushi with someone else, flip your chopsticks around and use the large ends to remove pieces to your own plate. Then flip back to the small ends to carry the food to your mouth.

Sashimi

While sushi can be a finger food, *sashimi* must be eaten with chopsticks.

To season *sashimi*, mix a small amount of *wasabi* into a saucer of soy sauce for dipping. Chefs may be offended if your soy sauce becomes a *wasabi* sauce and you drown the subtle flavor of the fish in the overpowering heat.

Sushi

Don't mix *wasabi* in the soy sauce for your *nigirizushi* because most pieces already include it under the topping.

Dip *nigirizushi* topping side down because dipping the rice in the soy sauce will cause the grains to fall apart.

Dip the piece only lightly in soy sauce. The chef may be offended to see a customer saturating his delicate creation.

Eat sushi in one or two bites and don't set down a half-eaten piece on your plate.

Eat a piece of ginger between bites to cleanse the palate. Takahashi says this is important "because each fish has a different taste."

If you plan to eat sushi at a Japanese restaurant, it is a good idea to sit at the bar. While you can order platters of sushi from a table, you won't be part of the lively conversations between the chef and his customers. You also won't be able to tell the chef how much *wasabi* to put on each piece, a good reason for opting for the bar and not a table.

While following the rules may whisk you away to the Far East, Japanese chefs and servers understand that Americans approach their food more casually. Most important to them is that patrons enjoy the food and atmosphere.

Takahashi agrees. He is not bothered at all by diners who glob *wasabi* in their soy sauce and then dip the already-seasoned sushi into the stew. Neither is he irked by those who let their *sashimi* swim in the mixture before eating it.

"No rules," he says emphatically. "Everybody is different in what they like."

Knowing that, curious gastronomes can venture forth without fear of committing a culinary faux pas.

Kanpai! ◘

HOW SAFE IS THAT SUSHI ON MY PLATE?

By David Green

While many people enjoy the flavor, texture and nutritional value of uncooked seafoods, they face some risks when eating raw or underprocessed fish and shellfish. The concern with raw fish is parasites.

Only two types of parasitic worms can infect humans; most parasites cannot adapt to their human hosts and are simply digested with no ill effect. Human infection by parasitic worms from marine fish is very rare.

Eating raw molluscan shellfish poses the greatest risk. Raw shellfish — particularly clams, mussels and oysters — can harbor viruses and bacteria that cooking destroys. Infection with the bacterium *Vibrio vulnificus* is rare and warded off by most people's immune systems. But raw seafood, especially shellfish, should not be eaten by anyone with liver disease, cancer (especially if taking anti-cancer drugs or radiation), AIDS, Hodgkin's disease, diabetes mellitus, chronic kidney disease or achlorhydria. Likewise, people who use immunosuppressive drugs or drugs that reduce stomach acidity or who chronically drink alcohol are advised to avoid these seafoods.

To reduce the risk of infection when eating raw seafoods, heed the Food and Drug Administration's recommendation that fish and shellfish intended for raw or partly cooked consumption be blast-frozen to -35 C or below for 15 hours or regularly frozen to -23 C or below for seven days. ◘

David Green is an extension seafood specialist with the North Carolina State University Seafood Laboratory in Morehead City.

Art Through the Eyes of a Child

By Brooks Preik

How did he create such beautiful pictures?
Outstanding art
We all love his work
Easy is what his work looks like, but it wasn't
Loves to draw people fishing
Loves using different, unusual colors

By Crystal, fourth grade

Small fingers stretch to trace the outline of a fishing boat in one of the bold images filling the classroom wall. In this fifth-grade class, students study a series of 10 serigraphs — silk-screen prints — by the late Claude Howell and explore the world of the artist and his reasons for painting. To prepare for this class, they watched a video about Howell's life. They know how he felt about art. They relate to him as if he were a friend, and they speak of him with a familiarity that removes all barriers to learning.

"He was smart," says Rachel. "And I like him because he was creative. He thought the triangle was a very strong symbol, and he used it a lot in his paintings." Rachel is totally unaware that in observing the clever incorporation of triangular configurations in Howell's art, she has learned to look beyond the obvious. She also has been briefly introduced to geometry, which might make a critical difference in her attitude toward that subject when she meets it again in high school.

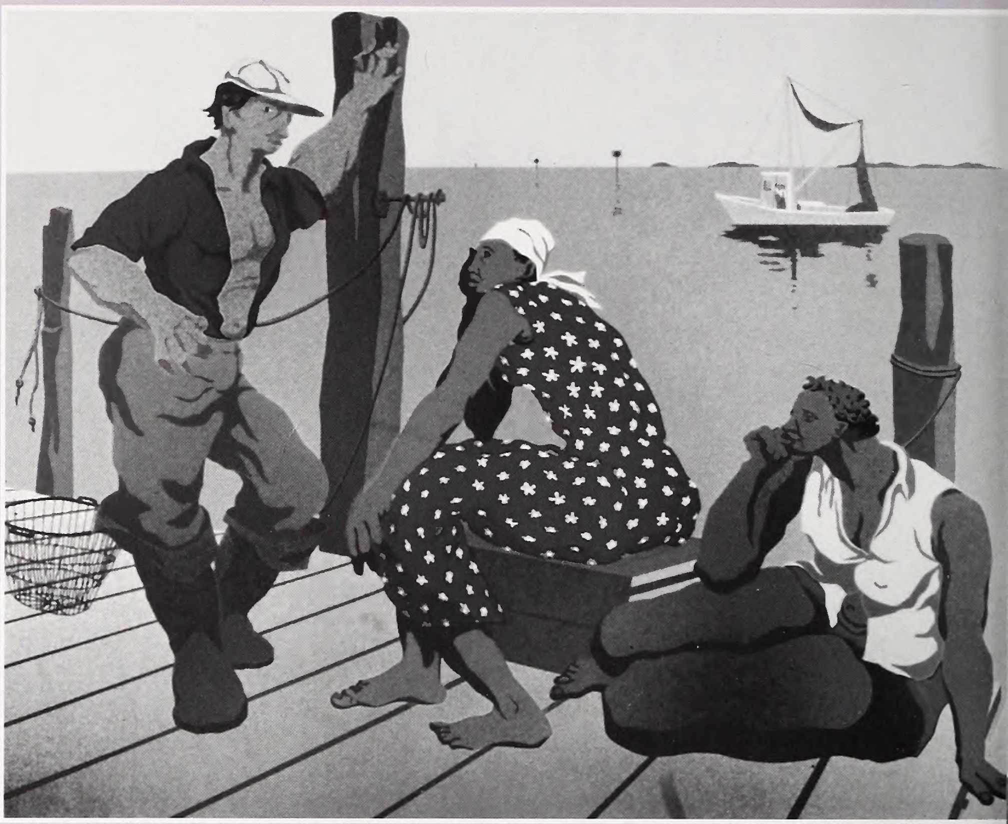
Tiffanie expresses a different feeling about the serigraphs. "I like things that are sort of regular — simple — that's why I like these prints."

Kayla's remarks reveal a child's self-confidence. "I'm a good artist too," she says, unhampered by modesty. "But I'd paint differently. I'd use fancier clothes."

Continued

Courtesy of St. John's Museum of Art

"Mending Nets: Sunny Day"



"Waiting for the Shrimpboat"

Scott D. Taylor

She points to the plain garments the artist has drawn. Kayla clearly loves talking about the artwork and speculating on the conversations the people in the pictures may be having. In a soft voice that suggests she is sharing a secret, Kayla reveals that the silk screens have caused her to think about art "with a little bit more intelligence."

Art through the eyes of a child — that is the focus of an innovative educational venture developed and sponsored by St. John's Museum of Art in Wilmington.

"Art in the Schools" takes original art into the classroom with an interdisciplinary approach that inspires students to investigate subjects from history to color theory, literature and geometry, says St. John's curator Anne Brennan, who initiated the project. The point is to make the study of art a "launching pad" for the study of traditional academic subjects, she says.

For instance, Howell's serigraphs of net-menders may prompt students to talk about the socioeconomic condition of the coast — both past and present. They raise the question of whether people still mend nets on the coast. Classes discuss how the nets have changed and how the fishing industry has revolutionized since Howell observed these scenes. He created the art between 1972 and 1992.

The exhibits also give students an opportunity to see original art outside of a museum setting. In the classroom, they can write about their impressions of the art and artist, or they can act out movements they see in the serigraphs with a dance.

Brennan and outreach coordinator Richard Sceiford, who prepared a teacher's guide and implemented the program, are elated with the positive feedback. "Art in the Schools" is scheduled for a tour of seven southeastern North Carolina county schools over the next several years. Brennan says she'd like to follow the Howell exhibit, compiled in December 1996, with one featuring "Jugtown" pottery from the Seagrove area.

"The key is the interdisciplinary angle," Brennan says. "Thus far, the art teachers are far exceeding our expectations in their creative use of the visual elements with which Claude constructs his images to relate concepts in math, creative writing, science and economics. We hope the classroom teachers will begin to see the benefits of this program and use it as well."

Kathy Glielmi, an art teacher at Berkeley Manor Elementary School on the Camp Lejeune Marine Corps Base, tries the Howell exhibit with great success. In the space of one 45-minute class, she leads the children in a lively discussion of the industries portrayed in Howell's work, the colors and shapes unique to these prints and the artist's point of view. Then she encourages student response in various forms of creative writing inspired by the artwork.

"We have talked about the fact that many times artists are visual artists, what they are producing is a painting or a sculpture, something that you can look at," she tells the students. "But if you are standing here viewing these pictures, you are pretty passive. So if we think about conceptual artists — and there's that word 'concepts' again, which means ideas — we are going to create word pictures so that when someone reads what you have written they will start to form a picture in their mind."

She offers them a choice of poetry forms. The favorite is an acrostic using the letters of the artist's name to begin sentences that describe him and his art.

"Or, you could write a story," she continues. "You could become one of the people in the pictures, or better still, maybe you're the boat. You might even be the net or a shrimp." This comment elicits gales of laughter with a quick exchange about the possibilities of ending up in a shrimp salad. Using the words of the artist himself, she helps the children realize that history, knowledge of the subject and sometimes even the learning of a specific skill are all part of the creative process.

Courtesy of St. John's Museum of Art

In an interview before his death, Howell defined it this way: "What makes art art? ... It is not simply copying what you see. That is reporting. You've got to know about why you paint. If you paint a man mending a net, you had better know how to mend a net."

Howell's importance as a regional artist is also introduced. The artist is a historian, commenting on the sociology as well as the economics of the time as he lives it, or perhaps even as he remembers it from his youth.

Glielmi uses terminology these young students can relate to. "Claude Howell's pictures were like a Kodak moment," she says. "He was capturing in his pictures bits and pieces of the life of the commercial fisherman, of the history of the fishing industry, because he was concerned that maybe 10, 50 years from now there may not be as much commercial fishing the way he grew up knowing about it on the coast of North Carolina. He was giving us little historical glimpses of what the coast was all about."

Though his fame goes far beyond the boundaries of this state, Howell was first and foremost a product of the coastal environment. However, he was not fond of being termed a regional artist. "I'm very much influenced by my surroundings because it's what I know and what I like. I paint the recognizable, but mainly the abstracted. I try to get the essence of the place rather than the way it looks," he said. And he added, "But yes, I paint a regional picture."

The artist was the only child of Claude Flynn and Jessie Campbell Howell. He was born on March 17, 1915, in the Carolina Apartments in Wilmington, one floor above the apartment that would become his home for most of his life. He cherished the view from his window overlooking the downtown area and preferred that location to any other in town.

As a young boy, hunting and fishing expeditions with his father became occasions to study wildflowers and birds and nature. His father was soon convinced that his son's first love was art. Both of his parents did everything possible to encourage this passion. When he was 17, his father died of a heart attack. The circumstances of the Great Depression forced his mother to

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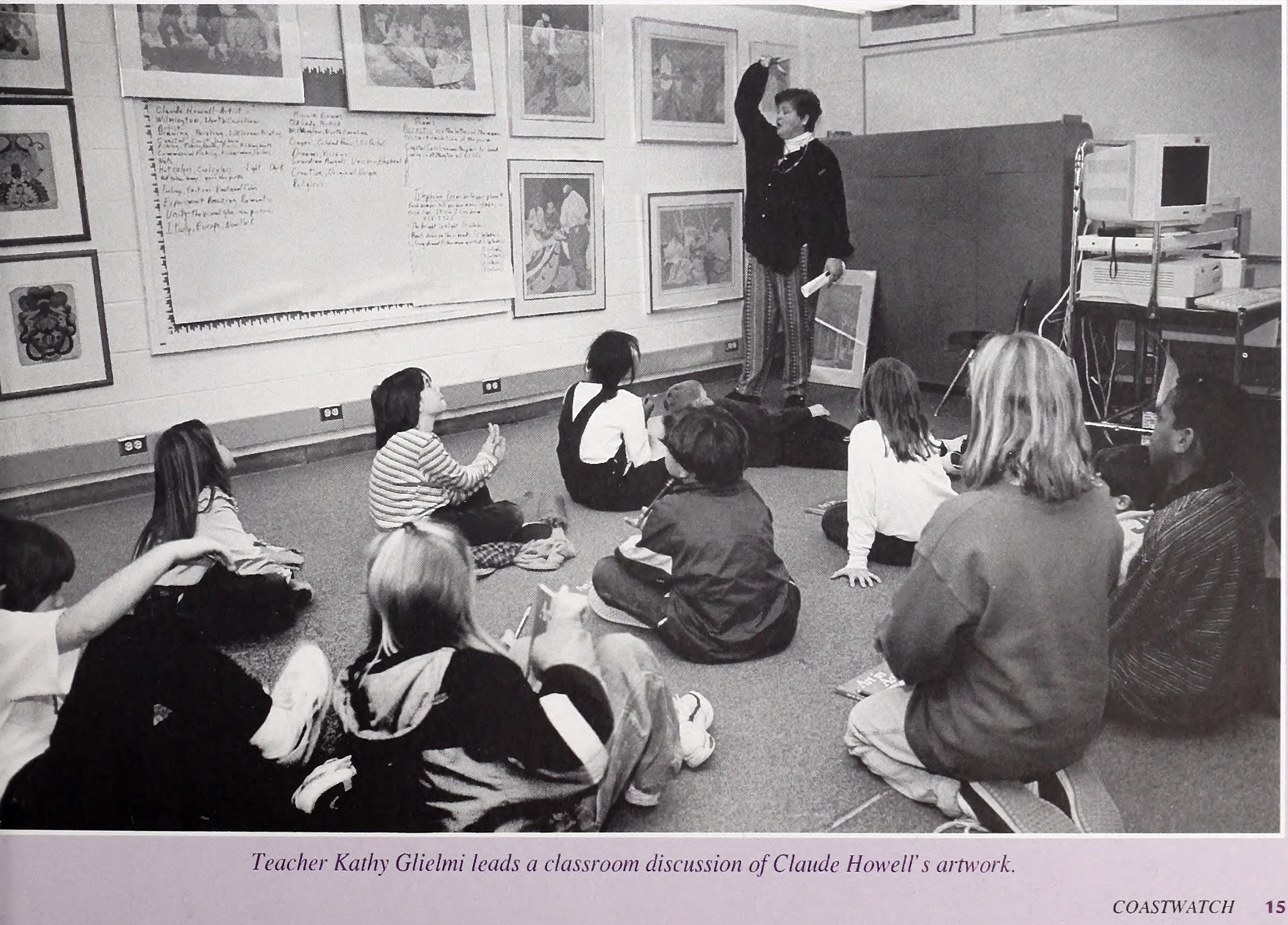


Teacher Kathy Glielmi leads a classroom discussion of Claude Howell's artwork.

take over her husband's business. She sold brick to contractors, often rising before dawn to meet them at the job site and then rushing home to prepare breakfast for her son. Knowing that her son would have to work to help supplement her income, Jessie Howell proposed a most unusual arrangement that suited them both. For years, Howell worked at the Atlantic Coastline Railroad and gave each paycheck to his mother. She, in turn, took care of all the finances and mundane responsibilities of the home and gave him whatever spending money he needed, thus providing him with the freedom to use all his spare time for painting. Much of his earlier art is very dark, largely because he most often painted at night when the light was poor. He and his mother lived together until her death in 1972. They frequently traveled together, and many of their delightful adventures are recorded in his personal journals.

Children are intrigued by the details of Howell's life, one that was very different in so many ways from their own. They are treated to these stories, narrated in the distinctive southern drawl of the artist, in a biographical documentary video entitled *A Quality of Light* that aired on the North Carolina public television network several years ago.

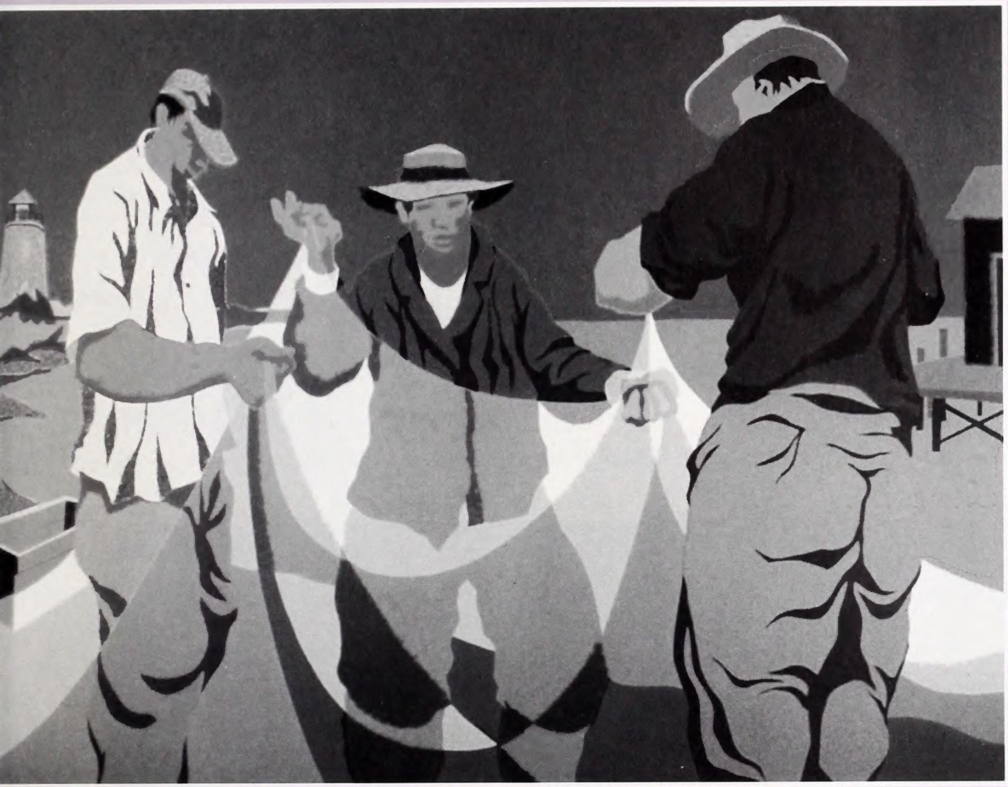
"I've always been fascinated with the way the world changes because of the quality of light — fascinated with light and space," Howell said.

In the course of their study, the children will become familiar with this preoccupation with light and space. Proportions are often distorted in the serigraphs. Heads are noticeably smaller and hands overly large, indicative of the fact that these men work with their hands. Kirk, a fifth-grader at Berkeley Manor School, points out that "the hands in the picture look big because you are looking straight at them, and the faces of the men are more in the background." Kirk is also taken with the varying shades of blue in the picture of a single fisherman sitting on the side of his boat surveying his catch. "I like all that blue," he says, "and the man counting his fish. The expression on his face is so good."

Howell knew those expressions firsthand. In 1948, he won a Rosenwald

Students write their impressions of the art and the artist.

Courtesy of St. John's Museum of Art



"Mending Nets: Northeaster"

Scott D. Taylor

Fellowship. For six months he was able to spend all his time drawing the coast of North Carolina. He lived among and studied the fishermen, net-menders and dockworkers. He sketched boats, nets, fish, shrimp, cottages, dunes and the sea — themes that would characterize much of his work.

During this period, Howell became more acutely aware of color and reflected light. He painted in the daytime, and he was immersed in the effects of light and color. Howell's own words introduce students to his use of "warm" and "cool" colors to create a mood or an emotion: "I know the sky is not orange but on a hot day, when the sandflies are biting and it is perfectly calm, you feel that everything is red, orange — the psychological use of color. It is not naturalistic. It is realistic. I am trying to give you the feeling of the sort of day it is."

Is it any wonder that these elementary school students are moved to write poetry?

Howell was a born teacher, and he loved it. In 1953, without benefit of a single day in college himself, he was asked to create an art department for Wilmington College, which later became the University of North Carolina at Wilmington. This opportunity enabled him finally to give up his job at the railroad and devote all of his time to art. He remained at the school until 1980.

The contributions of this artist are beyond measure. Howell dedicated his entire life to art and to his community. Long after he was physically unable to practice his craft, he was a commentator for public radio, painting colorful pictures with words in his memorable personal vignettes. No citizen of Wilmington ever loved St. John's Museum of Art more. He supported it with his time, his money and his art throughout his life and left his estate to that institution upon his death in February 1997. It is a fitting tribute to this remarkable native son that St. John's has developed the "Art in the Schools" program. Howell's graphic depictions of the saga of the sea and a bygone era in North Carolina's coastal history have created a singular artistic legacy that will continue to inspire and stir the imaginations of children. ▣

It was a very hot summer day as
I was sitting on the dock with my
friends Jessie and Jake. Our life of
being fishermen was okay! We have
been getting up at the crack of dawn
mending nets and driving the boat.
That day it was blazing hot, you
could feel the sweat coming off the
back of your neck. Jake was a
cautious, strong armed fisherman
who cared about other people.
Jessie was religious and creative;
she cared about friends and family ...
The dock was painted a mixture
of yellowish, orange, brown. The
ocean was blue, but the sun beating
down made it look a bright orange.
There were small islands behind the
boat. The painting I am trying to
describe was by Claude Howell.

By Lindsay, fifth grade

A HISTORIAN'S
COAST

What the Governor Grew

By David Cecelski • Photographs courtesy of the Tryon Palace Historic Sites and Gardens

A HISTORIAN'S *COAST*

Whenever I visit Tryon Palace in New Bern, I head straight to the kitchen garden. As an avid backyard gardener, I can't wait to see what new heirloom vegetables or now-forgotten herbs grow in this garden modeled after the kind popular when Governor William Tryon occupied the palace in 1770-71. I'm sure many visitors prefer to see how English colonists dressed for high tea, but garden buffs like me want to see how they fertilized their turnips.

As re-created by landscape architect Morley Williams in the 1950s, Tryon Palace's kitchen garden is an expansive, 16,200-square-foot plot surrounded by an 8-foot-high brick wall. Resplendent with vegetables, herbs and fruit trees, the garden beds are divided into quadrants separated by walkways, with two dipping wells in the middle. Adorning the garden walls is a wide array of espaliers, fruit trees pruned into formal patterns against a wall or fence.

Judging from his surviving letters, Tryon never paid much notice to the kitchen garden. He had his hands full ruling a colony on the verge of revolution against England, and he is best remembered for putting down the Regulators, piedmont farmers who revolted in 1771. Tryon may have left the garden's care to his cook. Unfortunately, we don't know who prepared the meals for his family in New Bern — knowing that would possibly tell us much about the kitchen garden. Tryon employed a French chef named Pierre LeBlanc when he was governor at Brunswick (the colonial capital was moved from Brunswick to New Bern when the palace was built in 1769). The next royal governor, Josiah Martin, had an African-American cook whose name we don't know.

Historical records say almost nothing about what actually grew in Tryon's kitchen garden. Only because Martin was accused of hiding a barrel of gunpowder for use against the American revolutionaries "under a fine bed of cabbage" in 1775 do we know with certainty that any vegetable was ever grown at the colonial capitol. Even the kitchen garden's original design was a mystery until just a few years ago. In 1991, Tryon Palace researchers discovered the original garden plan at the Academica Nacional de la Historia in Venezuela. The building's architect, John Hawks, had given it to a Venezuelan traveler named Francisco de Miranda when he passed through New Bern in 1783.

Even without the kind of detailed journals that Thomas Jefferson left of his kitchen garden at Monticello, the Tryon Palace gardeners try admirably to capture the soul of the original kitchen garden. In addition to scavenging every mention of garden and cookery from 18th-century travel accounts, they draw on the classic texts such as Philip Miller's *The Gardener's Dictionary* (1754) and ingredients listed in early American cookbooks such as Amelia Simmons' *American Cookery* (1796) and Mary Randolph's *The Virginia House-wife* (1802).

They also realize that the original kitchen garden would have reflected an extraordinary mixing of American, European and African crops. The garden would have combined sweet potatoes, peppers, green beans and squash cultivated by Native Americans; cabbages, peas, turnips and other vegetables found in any English garden; and okra, watermelons and eggplant, whose seeds had probably arrived in America aboard slave ships from Africa. All can be found in the kitchen garden today.

Several features distinguish Tryon Palace's kitchen garden from modern vegetable gardens like mine. Perhaps most importantly, the palace's garden holds many vegetables rarely grown or eaten in the United States today. Since the 18th century, for example, new lettuce hybrids have displaced many other leafy greens in American diets. But at Tryon Palace visitors can still find dandelions, sorrel (which adds a lemony flavor to a salad) and creasy greens grown for the dinner table as well as many small shrubs like hyssop (*Hyssopus officinalis*), a pungently aromatic plant used to flavor salads, soups and meat dishes.

A far greater variety of root crops would also have grown in Tryon's kitchen garden. The Irish potato, actually cultivated by ancestors of the Incas at least 6,000 years before it was grown in Ireland, later overshadowed other root crops in American gardens, but that was not yet the case in the 1770s. At Tryon Palace, visitors find still-common roots such as radishes, carrots, beets, sweet potatoes, turnips and onions. Turnips, in fact, were wildly popular vegetables in colonial gardens, far more so than today. The garden also includes root crops not very common now, such as parsnips, skirrits and salsify. Stewed, baked or used in a cream sauce, salsify *(Tragopogon porrifolius)* is known as the "oyster

Continued

plant" because its flavor resembles that of fried oysters.

Cardoon is another vegetable grown at Tryon Palace that has fallen out of favor. Cultivated for at least 3,000 years, cardoon (*Cynara cardunculus*) is an ancestor of the globe artichoke. Colonial cooks blanched its stalks like celery and served them as a side dish, in stews or soups, pickled, or dipped in batter and fried.

Other vegetables grown in my backyard garden may not belong in Tryon Palace's kitchen garden. The most notable is the tomato. Named from the Aztec word *tomatl*, the tomato was originally a weedy, small-fruited native of Peru, Chile, Bolivia and Ecuador north to Mexico. Spanish conquistadors found the *tomatl* growing in Emperor Montezuma's gardens in 1519 and carried the fruit to Europe. There, it became an essential part of many cuisines, especially in southern Italy, where it was called the *pomodoro* (golden apple). The tomato was greeted more skeptically in England, however, and it wasn't described as a food plant in the American colonies until Jefferson's *Garden Book* in 1781. It is doubtful that tomatoes would have yet been grown in New Bern during Tryon's governorship.

Unlike most backyard gardens today, the kitchen garden also holds a wide variety of heirloom vegetables. Most modern vegetables are fairly recent hybrids. With only a few corporate agribusinesses monopolizing the seed market, fewer plant varieties are cultivated, and a growing number of gardeners purposefully collect and raise older genetic varieties (known as heirlooms) to preserve them. Finding heirloom varieties dating back to Tryon's day is difficult but not impossible. One of the carrot varieties at Tryon Palace today — the "Long Orange Improved" — dates to Dutch breeders in 1620 and has been cultivated in North America for 350 years.

The kitchen garden at Tryon Palace also mingles herbs and vegetables, a practice true to the colonial period but much less common today as gardeners tend to cultivate separate herb gardens. The herbs originally in the kitchen garden would have been used for culinary purposes, but a colonial kitchen garden also functioned as a source of medicines. Julie Craig, the current kitchen gardener,

Above: Jerusalem artichoke
At right: eggplant

grows dozens of herb varieties, including hyssop, used as a purgative and emetic; mints, used to soothe external inflammation; lovage, used as a diuretic and for relief of gas; and valerian, used as a tranquilizer and calmative.

Many of the herbs grown in the kitchen garden had other uses. Hops, best known today as a beer ingredient, can be eaten boiled and buttered like asparagus but has also traditionally been used to treat insomnia and liver problems and as a source of yellow dye for wool. Soapwort (*Saponaria officinalis*) makes an excellent skin cleanser and shampoo. Lavender, of course, produces a sweet fragrance and has been used to treat stress-related headaches, but it also helps prevent moth damage in woolens.

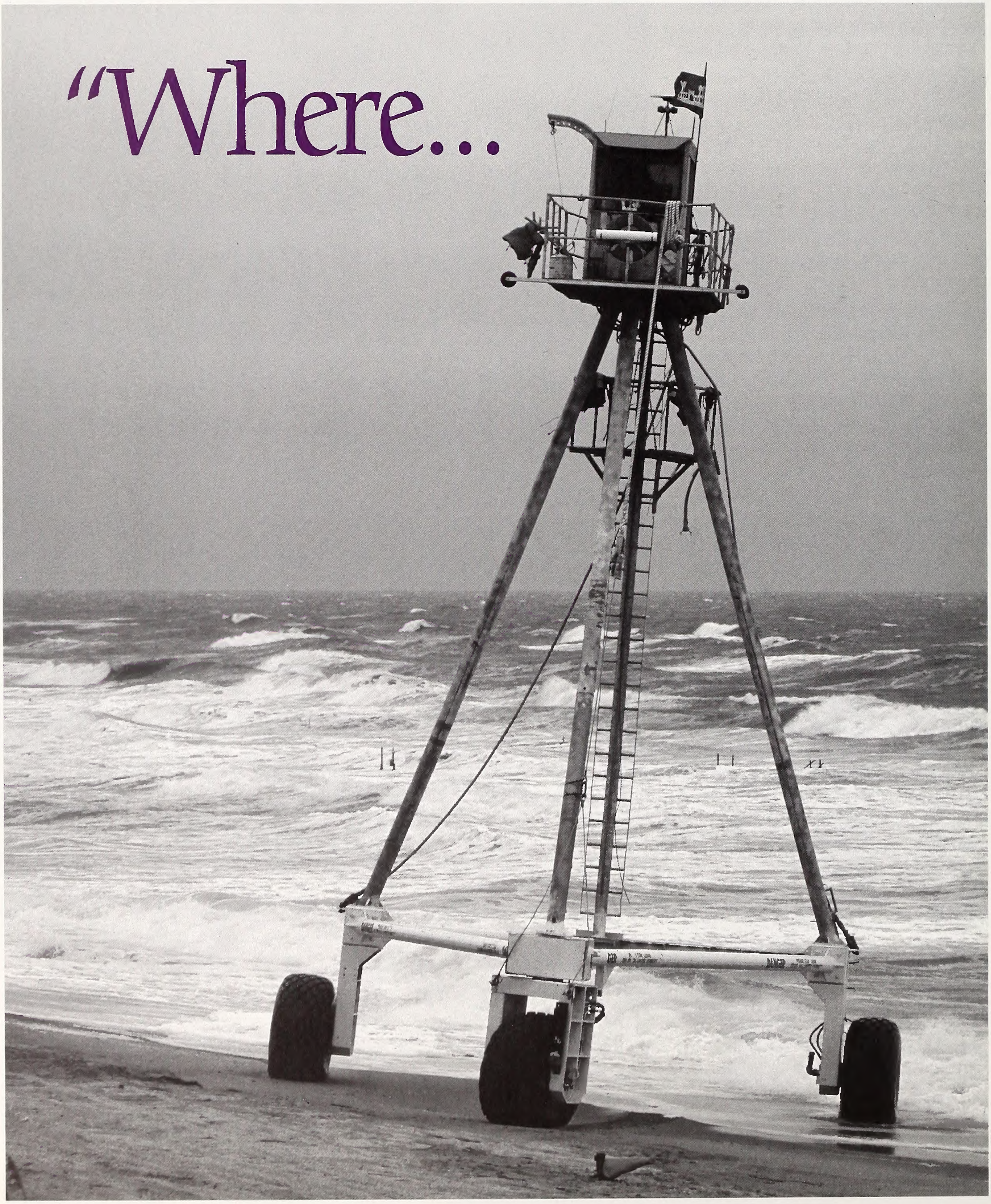
One of the palace gardeners' most interesting projects is to investigate colonial fertilizers and pesticides. Many people consider organic gardening something of a fad today, but it was the universal practice in Tryon's era. Craig fertilizes the kitchen garden with horse manure, compost and crab meal, much as colonial gardeners did. She also avoids the potentially harmful effects of synthetic pesticides by experimenting with different pesticides used in the colonial period, including soap, tobacco dust, teas and smoke blown over the plants.

Above: hyacinth bean
At left: cardoon

Unlike the gorgeous rose gardens and sculpted hedges elsewhere at Tryon Palace, the kitchen garden was always a union of beauty and practicality. In the 19th century, the kind of walled English garden re-created in New Bern fell out of fashion. But as kitchen gardens spread into backyards and fields, coastal residents discovered the pleasures of seeing out in the open their flowering vines, brightly-colored tomatoes and pumpkins, and the sculpturelike elegance of their stakes and trellises. Today, vegetable gardens remain a source of pride and joy for many of us — and one of the best reminders that beauty and practicality can go hand in hand.

David Cecelski is a historian at the University of North Carolina-Chapel Hill's Southern Oral History Program and a regular columnist for Coastwatch.

"Where...



The CRAB enters the surf.

Does the Sand Go?"

By Elizabeth Burke • Photographs by Michael Halminski

You've just eased yourself into a beach chair and traded a bottle of sunscreen for the fat, juicy novel you found at your rental house. Everything seems perfect. But when you think the sweet tea in your cooler is the only thing calling your name, you hear somebody say, "I don't know where the sand goes. Ask mom, she probably knows!"

"It goes away, like you should," you holler back, burying your toes in the sand and your nose deeper in the novel.

Ironically, for all the time we spend at the beach, this is practically all we know about sand. Questions like "Where does the sand go?" are complicated, and except for parental guesses, they have remained largely unanswered despite years of scientific study. One reason is that tracking the motion of a single grain of sand on the beach, much less a wave full of them, is nearly impossible.

This past summer and fall, more than 100 of the world's most accomplished oceanographers, coastal geologists and engineers gathered on the Outer Banks at the U.S. Army Corps of Engineers Field Research Facility (FRF) at Duck to conduct the largest coastal field research project ever. Dubbed SandyDuck '97, it was a series of 30 separate experiments designed to answer the sorts of childlike questions that vex even the experts. Most of the funding came from three government agencies: the Corps of Engineers, the Office of Naval Research and the U.S. Geological Survey.

The scientists came to learn why the beach looks different season to season and year to year. They wanted to understand what causes ripples, dunes and sandbars. And after all the data is analyzed, they hope to say where the sand goes and to predict if and when it will return. That knowledge can help save property from the ravages of storms and long-term erosion, says coastal geologist Tom Drake of North Carolina State University.

Peter Dickson gives perspective to the size of the CRAB's wheels.

"For years, oceanographers have studied waves, and they always wished the sand would stay put so that the ocean would resemble a big laboratory wave tank. Any change in the beach was a tremendous nuisance," Drake says. "At the same time, geologists studying the sand and barrier islands were wishing the ocean could be drained so they could see the bottom."

SandyDuck teamed these oceanographers and geologists, and together they used some ingenious methods for looking at sand and waves and how they affect one another.

So, if you want to know more about the path of a sand grain, what do you do?

If you're Oregon State University's Rob Holman, you keep watch from a distance — and a height of 120 feet. Holman, a pioneer in the field of video imaging, has mounted five video cameras on the FRF's video tower to give him a bird's-eye view of every wave that comes ashore. But he does more than just watch the waves break; he uses the video images to map changes in the sandbar over time.

"With the technology we have now, we can measure how each wave progresses," Holman says. "We can also look at one individual point on the beach and see how the beach changes over days or months."

For Drake, the best view is *in* the water. He uses a 3-foot-long, torpedo-shaped side-scan sonar mounted on the underside of the Army's Coastal Research Amphibious Buggy (CRAB).

"The side-scan sonar generates a picture of the bottom using sound and shows us the shape of dunelike features called megaripples, rip-current channels and offshore sandbars," Drake says. "It's the same technology used to search for shipwrecks like the *Titanic* or downed aircraft."

Researchers use the same techniques and technology in another long-

Continued

term study, sponsored by the Army Research Office, to map the seafloor in the surf zone out to depths of 30 or 40 feet. The goal is to see how the seafloor changes as storms move sand around.

"We're very interested in what happens when erosion removes all the sand on a particular part of the seafloor, exposing older rocks that aren't erodible," Drake says. "There isn't much sand on the barrier islands, sometimes none, yet all the models for predicting beach change assume that there is an infinite supply of sand. So knowing the response of the beach when the sand supply disappears is very important to understanding the North Carolina coast."

Duke University graduate student Rebecca Beavers discovered that plenty of sand is moving into the water at 40-foot-depths, far deeper than sand is typically thought to move. Beavers dons scuba gear to extract sand samples by hammering square cans of stainless steel into the seafloor. With other SandyDuck scientists monitoring waves, currents and bottom changes between the times that the cores are extracted, Beavers and her colleagues can compare the sedimentary strata or layers in the core to the processes that created them. After visiting the same sample sites and taking a time sequence of cores over several years, she sees that layers of deposited sand observed in the first cores are now missing. These have been replaced in subsequent cores with a new sequence of layers, usually sand that has been deposited by storms. This is clear evidence of erosion at the sample sites, she concludes.

With all the beaches in the world, why choose Duck for this research? Although the area is famous for its recreational merits, Duck is also widely recognized in the scientific community as the perfect test site for wave research. Bill Birkemeier, chief of the FRF and principal coordinator of SandyDuck '97, notes that Duck has been a focal point for coastal experiments for many years. Engineers and scientists at FRF have gathered more than 20 years worth of weather and wave data to support the research.

"This is probably the best-studied beach in the world because we have a straight beach with ocean exposure and variable conditions — calm to stormy and everything in between," Birkemeier says. "And the FRF has both the expertise and the specialized equipment required to work in the dynamic coastal zone."

Take the CRAB, which looks as if Dr. Seuss designed it in a moment of oceanographic whimsy. This 35-foot-tall motorized tripod was driven daily over the dunes and into the ocean to map the seafloor. The CRAB was also used to install instruments, collect sediment samples and tug instrumented sleds into the surf. Regular surveys of the seafloor, made with the CRAB since 1980, have produced perhaps the most valuable data at the FRF. These one-of-a-kind seafloor maps help near-shore scientists to precisely place their instruments for the best research results. For example, if they know from the maps where a sandbar usually migrates during a big storm, then they know where to place instruments to best record how it moves. Otherwise, the instruments might be buried. They can also measure subtle variations in wave height and water surface elevation — forces that drive both longshore and rip currents.

Driving the CRAB, which typically motors along at a top speed of 2 mph, can also be a first-class, white-knuckle experience. Drake recalls one weekend when graduate student Peter Dickson, one of three CRAB drivers, headed into the surf zone during a nor'easter. It was the kind of day you'd watch seagulls fly backward in the wind, he says. Winds were up to 40 mph, waves occasionally reached 10 feet and the longshore current ripped past. The CRAB, slapped by one of these storm waves, took a 4-foot sidestep and almost entangled in a picket fence of pipes that hold instruments.

The CRAB driver uses a computer navigation system much more accurate

Top Left: *The Duck pier is a stable base for research instruments.*
Bottom Left: *Rebecca Beavers examines sedimentary cores.*
Above: *Video cameras give researchers a bird's-eye view of waves and sandbar movement.*

than those used to land airliners, and each of the tires is filled with nearly a ton of water to keep it on the bottom. The vehicle once tipped over on a too-steep slope in calm water. Every precaution is taken now to make sure that doesn't happen again.

Any discussion of valuable assets at the FRF wouldn't be complete without a mention of the Duck pier, which is central to gathering information about waves and currents. The concrete and steel pier, which reaches about a third of a mile from the dunes to the ocean, was built in the late '70s. It is mounted on pilings that are set 40 feet apart and extend 50 to 100 feet beneath the sediment surface. The platform is unshakable, providing a stable base for oceanographic instrumentation.

It's the perfect platform for the Sensor Insertion System (SIS), a custom-designed crane that precisely places instruments in the ocean. "Most sediment transport occurs when waves are really big," Birkemeier says. "Of course, measurements in waves when conditions are at their worst is difficult. So, with this system, we can measure waves whenever we want to, even in our biggest waves."

You might think that watching sensors float in the waves would be as popular as an underwater basket-weaving convention. But some of the gizmos at SandyDuck had tourists and locals doing double takes. This summer, Beavers took more than 3,500 curious people on hour-long tours of the research site.

"People saw the CRAB and the LARC, or Lighter Amphibious Resupply Cargo vessel, and wanted to know what we were doing," she says. "Since my tour was a thinly disguised introductory lecture on sediment transport, many visitors were led to ask questions about our work in the surf zone and how the beach system works. But when we came to the end of the tour, it seemed that for many people it came down to pretty much the same thing — how will this research save property during a hurricane? Providing a definitive answer to that important question is one of the goals of the whole project."

Though the experiments are finished, Birkemeier says the benefits from the research necessarily have a time lag. "With the SandyDuck research, scientists have to take their data back to their institutions and start analyzing them this winter. Then they begin the process of exposing their work to peer review, publishing results in journals and reporting their results at meetings. It is from this point forward that the results begin to make their way into the hands of engineers and others who can apply the science in ways that are of direct benefit to consumers."

Drake adds that the studies have a strong connection to North Carolina coastal science and will help answer the public's questions and concerns about coastal erosion and the role of geology and storms in shoreline change, the role of hurricanes in creating inlets, shoreline impacts of inlet migration (or stopping inlet migration with jetties), groundwater problems related to development on barrier islands, beach erosion at the Cape Hatteras lighthouse — the whole gamut of coastal issues.

"It's clear that we have a very thin, valuable veneer of sand on which thousands of homes now rest," Drake says. "No longer can homes just be pulled back from the shore when the beach disappeared, as they used to do in the days of Orville and Wilbur (Wright). As the shoreline moves inexorably west, we need to put together a strategy for our beaches."

More information about SandyDuck '97 is available on the World Wide Web. Go to http://www.frf.usace.army.mil and click on "SandyDuck." There's even a slide show with a week-by-week view of experiments, equipment and participating scientists. ◘

Free-lance writer Elizabeth Burke is married to SandyDuck's Tom Drake.

A Heartfelt Menu for Your Valentine

By Kathy Hart

With Valentine's Day approaching faster than you can say February, it's time to think of something special for the one who warms your heart.

Chocolates? Champagne? A gourmet dinner?

All fine for the day itself. But you can give your loved one a lifelong gift for the heart — a diet rich in seafood.

For more than 15 years, scientists and doctors have touted the health benefits of the ocean catch. Most major health organizations suggest including seafood in your diet two to four times per week.

Why does seafood get such a strong nod of approval? Its attributes are greater than the number of cherry cordials in your valentine chocolates.

Seafood is:

- easily digested;
- low in calories;
- high in protein;
- low in total fat, saturated fat and cholesterol;
- high in polyunsaturated fats and omega-3 fatty acids;
- low in sodium;
- a good source of vitamins and minerals such as thiamine, riboflavin, calcium, magnesium, niacin, phosphorus, potassium, iron, iodine, fluoride, zinc, selenium and copper.

According to a 1997 *New England Journal of Medicine* study, eating 35 grams of fish daily (less than one serving) almost halves your risk of a heart attack. These heartfelt benefits result from seafood's high content of polyunsaturated fat — fat rich in omega-3 fatty acids.

Omega-3s appear to help the body fight heart disease. They lower triglyceride levels and low-density lipoproteins (LDLs), the bad cholesterol, while raising levels of high-density lipoproteins (HDLs), the good cholesterol. Omega-3s help thin the blood, making it less likely to clot and form plaque that can clog blood vessels and lead to heart attacks and strokes.

But fish and shellfish benefit more than just the heart. Researchers have found that the omega-3 fatty acids may relieve the inflammation of arthritis and protect the body from diabetes, high blood pressure, psoriasis and migraine headaches. Japanese scientists learned that people who eat fish daily reduce the risk of certain cancers by three to five times.

Researchers are also studying how DHA (docasahexaenoic acid), one kind of omega-3 fatty acid, affects everything from proper brain development in infants to the prevention of brain function loss in the elderly.

While researchers continue to decipher the benefits of omega-3 fatty acids, there's no doubt about seafood's low calorie and sodium content. For those watching their weight or salt intake, fish and shellfish make an ideal source of protein. Four ounces of raw haddock, cod or flounder contain only 85 calories.

But if seafood is to be health food,

throw away the frying pan and forget drenching your catch in rich butter or cream sauces. Instead, bake, broil, steam or grill your ocean catch, and use herbs, spices, vegetables, fruit juices or wine to add extra flavor.

Healthful Recipes*

Baked Grouper Fillets with Mushrooms

- 1 1/2 pounds grouper (skinless) or other lean fillets
- 1 medium onion, sliced
- 1 cup sliced fresh mushrooms
- 2 tablespoons chopped fresh parsley
- 2 tablespoons tarragon wine vinegar
- 2 tablespoons olive oil
- 1 teaspoon dried dill
- white pepper
- bay leaves

Combine onion, mushrooms, parsley, vinegar, oil and dill. Place half of mixture in baking pan. Place fillets on top of mixture. Sprinkle with pepper and place half a small bay leaf on each fillet.

Top with remaining mushroom mixture. Cover and bake at 425 F for 10 minutes. Remove cover and continue baking 10 to 15 minutes or until fish flakes easily when tested with a fork. Remove bay leaves before serving. Serves 4 to 5.

Fillets in Curry Sauce

- 2 pounds snapper, trout or other lean fillets
- white pepper
- 1 cup canned tomatoes, chopped
- 1/2 cup thinly sliced green onions
- 1/4 cup skim milk
- 2 teaspoons cornstarch
- 2 teaspoons finely chopped fresh parsley
- 2 cloves garlic, pressed
- 2 teaspoons curry powder (or more to taste)
- 1/2 teaspoon dried basil leaves

Sprinkle fish with pepper. Place in baking dish. Layer tomatoes and green onions over fish. In bowl, combine milk and cornstarch, stirring until dissolved. Add remaining ingredients; mix well. Pour mixture over fish. Bake uncovered at 400 F for 15 to 20 minutes or until fish flakes easily when tested with a fork. Serves 6.

Indonesian Grilled Shrimp

- 2 pounds shrimp, peeled
- 2 tablespoons fresh lemon juice
- 1 tablespoon fresh lime juice
- 1/4 teaspoon cayenne pepper
- 1/2 teaspoon ground coriander
- 3 tablespoons molasses
- 1 large clove garlic, pressed
- 2 teaspoons grated fresh lemon peel
- 2 tablespoons vegetable oil

Stir together all ingredients except shrimp. Place shrimp in marinade and marinate for 30 minutes.

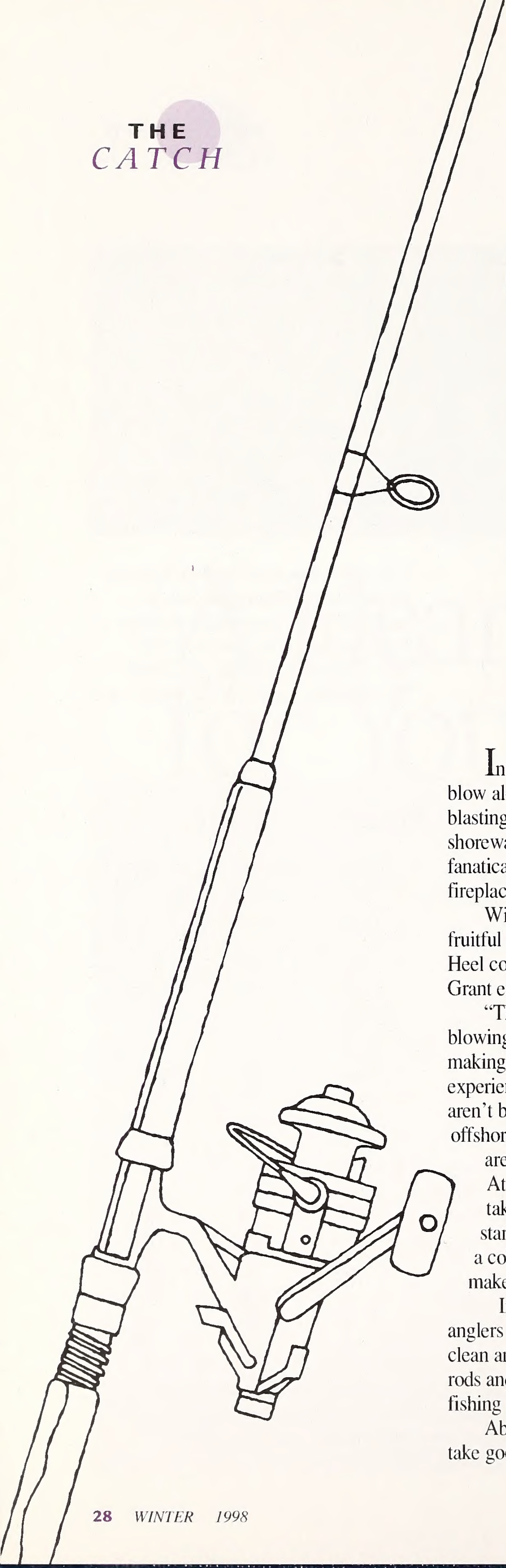
Remove shrimp and reserve marinade. Thread shrimp on metal or wooden skewers. (If using wooden skewers, soak them in cold water for 1 hour before grilling.) Grill about 4 inches over hot coals until lightly browned, about 4 minutes each side, brushing with reserved marinade. Serves 8.

* *Recipes taken from* No-Salt Seafood: All the Flavor Without the Salt. *To purchase a copy, send $3.50 to North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC, 27695. Ask for publication UNC-SG-89-07.*

Fish and Shellfish Nutritional Values

100 grams, 3 1/2 oz., raw edible portion	*Calories*	*Fat (grams)*	*Sodium (mgs)*	*Cholesterol (mgs)*	*Omega-3 fatty acids (grams)*
• bluefish	124	4.2	60	59	1.2
• clams	80	1.5	80	40	0.1
• crab, blue	87	1.1	293	78	0.3
• croaker	85	0.8	80	50	0.2
• flounder	90	1.4	56	50	0.2
• grouper	87	0.5	80	50	0.3
• mackerel	160	7.3	80	40	2.5
• mahi mahi	102	1.0	130	85	0.1
• oysters	70	1.2	75	50	0.6
• pompano	164	9.8	65	50	0.6
• scallops	82	0.2	160	50	0.2
• shrimp	90	0.8	140	158	0.3
• snapper	97	1.8	50	40	0.5
• salmon	116	3.5	67	52	1.0
• sea bass	97	2.0	68	41	0.6
• shark	130	4.5	79	51	0.8
• swordfish	120	4.4	70	50	0.2
• tuna	102	3.0	50	25	1.3

These numbers are only a guide. Values vary with species, water temperature, catch location and season caught. Chart excerpted from Light-Hearted Seafood *by Janis Harsila, R.D., and Evie Hanson, published by the National Seafood Educators.*



Casting Off the Fishing Blues of Winter

By Kathy Hart

In the winter, nor'easters regularly blow along the North Carolina coast, blasting cold biting winds and icy rains shoreward and driving all but the most fanatical anglers to their recliners by the fireplace.

Winter is neither an inviting nor fruitful time to cast a line along the Tar Heel coast, says North Carolina Sea Grant extension agent Jim Bahen.

"The wind seems to always be blowing and blowing hard in the winter, making fishing a cold, wet, miserable experience," he says. "And the fish just aren't biting. Many species move offshore to warmer water, and others are sluggish from the winter cold. At this time of year, fish just aren't taking the bait. It's not worth standing on the beach or the pier in a cold gale if you're not going to make a good catch."

Instead, Bahen suggests that anglers use these inclement days to clean and prepare their tackle boxes, rods and reels for spring and better fishing days ahead.

About 40 percent of the sportfishers take good care of their fishing equipment, Bahen estimates. The remaining 60 percent toss their gear in the garage or basement at the end of their angling adventures. And that's bad news, particularly if an angler has been casting in coastal waters, where salt water and sand can take their toll.

"The type of fisherman you are is sometimes reflected by the condition of your tackle," Bahen says. "Serious recreational fishermen take very good care of their gear."

To clean up your act and improve your image, start by giving the tackle box a good cleaning. Remove all lures, jigs, hooks and sinkers. Rinse them gently with tap water and air dry. Be sure to pull off any pieces of dried bait still hugging the hooks.

Bahen says fishers should really follow this cleanup regimen after every fishing trip, especially coastal ones. Ocean spray can coat tackle with a damp, salty film, providing a sure formula for rust. A light spraying with fresh water works wonders.

If the hooks and jigs have rusted, replace them. A jab with a rusty hook can send you to the doctor for a tetanus shot. Small hooks such as those found on spot rigs should be thrown away, but treble hooks like those on a MirrOlure can be replaced using a small screwdriver.

Dump all the sand out of the tackle box itself. Rinse and dry it too. Then take a few minutes to organize your tackle so that you can reach for that Hopkins jig or MirrOlure without fumbling through your box.

Your rods and reels need preventative maintenance too. Start by rinsing the rods with water and wiping them dry with a chamois cloth. Then take another dry cotton cloth and spray it lightly with an oily lubricant. Use the cloth to wipe down the rod, the reel seat and the guides, providing a thin coat of oily protection.

Remove the reel from the rod. Using a garden hose, rinse the reel with a gentle spray. Salt always accumulates underneath the reel seat. Dry it thoroughly with a chamois cloth. If you have a spinning reel, remove the spool. Then rinse, dry and oil the reel cover, outside and inside. Remember to loosen all reel drags when storing.

Bahen says winter is also a good time to change the line on your reels.

"Monofilament line does deteriorate," he says. "And it seems the line always breaks at the most inappropriate times — with a big fish pulling at the end."

To prevent breakage and the disappointment of losing a sizable catch, replace all or part of your line. Some anglers prefer to leave a base wrap and replace only half to three-quarters of their line. Others strip their reels of all line and start new. In either case, be sure to dispose of your line appropriately in a trash can or recycling bin.

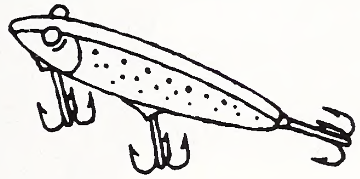
Once you have cleaned, organized and properly stored your fishing equipment, then it's time to relax by the fire with a few good fishing magazines. These readings will rekindle your spirit and have you dreaming of catches to come.

Although many national magazines cover fishing, Bahen suggests several Tar Heel periodicals with articles by regional writers who know the area and the fish: *Carolina Adventure*, *The Fishing Report* and *North Carolina Sportsman*. He also recommends regionally produced outdoor TV shows such as *North Carolina Saltwater*.

If you have a computer and access to the World Wide Web, you can fish for information on-line. The web offers a wealth of fishing information posted by the National Marine Fisheries Service, sportfishing organizations and magazines, fishing guides, bait-and-tackle companies and private individuals. Or visit a chat room devoted to fishing topics and reel in a new friend who shares your passion for saltwater fly-fishing.

You can also attend a boat or outdoor show. Held in January, February or early March, these popular shows provide a venue for dealers to display the latest tackle, equipment and boats. Or if you want to learn something new, attend an educational seminar. Many sports and outdoor magazines schedule educational seminars at locations throughout the country during the winter months. Check your favorite magazine for a list of seminar sites and fees.

Although winter may not be a good time to cast a line for an offshore catch, it's certainly the best time of the year to fish for knowledge and equipment that will make you a better angler when temperatures warm and the fish are again taking the bait.



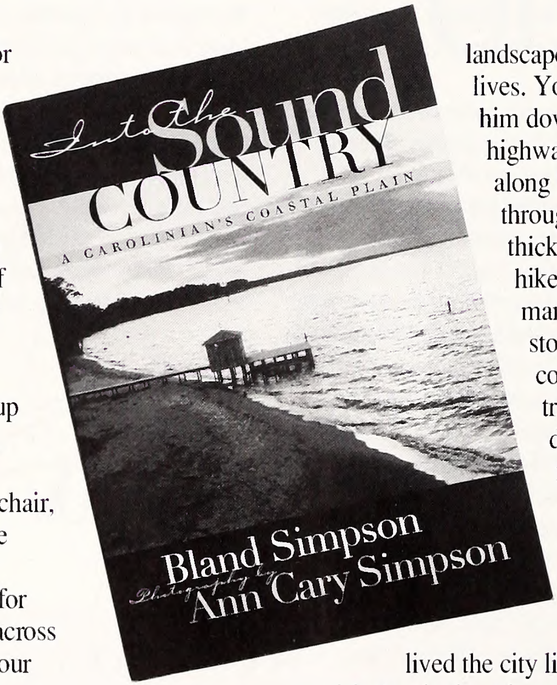
Casting a Net for Fishy Web Sites

Below are a just a few World Wide Web sites that offer information about everything from fishing vacations to tackle dealers.

- ***Fishing "E" Net Magazine***
  www.fishingenet.com
- ***Flyfisherman's Virtual Flyshop***
  www.flyshop.com
- ***FishNet Links***
  www.fishersnet.com
  (Provides links to web pages offering information on a variety of fishing topics.)
- ***Fishing: Aqueous Search Engine***
  www.aqueous.com
  (Supplies visitors with information on conferences, software, lures, tours, vacations and more. Also provides a list of fishing-related web sites.)
- ***Hunting, Fishing and Outdoors Online Magazine***
  www.wildgoose.com
- ***Fish and Game Finder Magazine***
  www.fishandgame.com
- ***All Coast Sportfishing Magazine***
  www.sport-fish-info.com
  (From this web site, you can swap fishing stories, look up recipes or chuckle over fishing comics.)

Sound Reading for Chilly Winter Evenings

By Daun Daemon • Photographs by Herman Lankford



The time for splashing in the waves is months past, but the call of the sea is as strong now as in the sultry days of summer. Wintry afternoons are perfect for whipping up a cup of hot chocolate, sitting in your favorite reading chair, and exploring the Coastal Plain or discovering tips for your next foray across the dunes with your camera. Your young friends can read alongside and swim like a shark in the sea or romp with a pet wave.

Into the Sound Country: A Carolinian's Coastal Plain, by Bland Simpson with photographs by Ann Cary Simpson (University of North Carolina Press, ISBN 0-8078-4686-4).

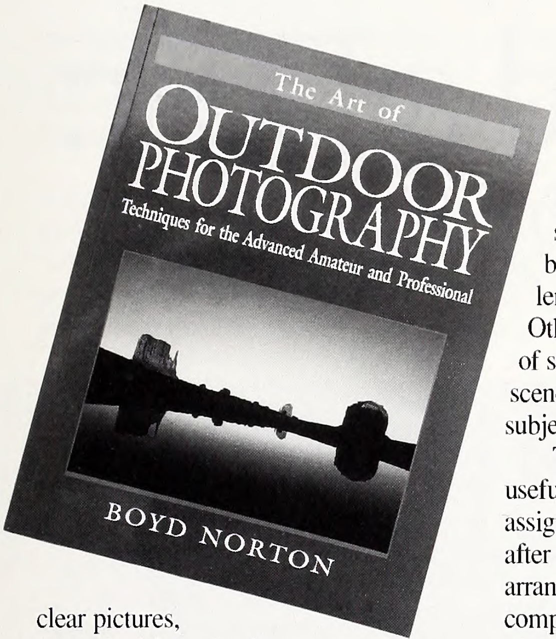
Bland Simpson does not sit still. In *Into the Sound Country*, he's always moving — in a car, on foot, by boat and through time right into the Tar Heel landscape and people's lives. You will ride with him down coastal highways and bump along backroads, glide through wetlands thick with vines and hike through maritime forests, stop off at a country store and travel back to the days when flocks of ducks and geese rolled across the sky like thick smoke.

If you've lived the city life all your years or visited only the prime tourist spots on the coast, Simpson will introduce you to a North Carolina you've never experienced. He easily juxtaposes the crazy clutter of coastal towns and cities with the simple serenity of lowland swampscapes. The narrative is a delightful, sometimes brutal, often revelatory tumble of images that never overwhelms and will on occasion catch your breath and knock it clear to the sounds.

Using such images, Simpson reminds us of the historical importance of scuppernong grapes, the brutality of the Tuscarora Wars, the eerie mystery of the Maco light (which Simpson himself witnessed one spooky night) and much more. He recounts murder mysteries, leaves no questions about where he stands on environmental issues and demonstrates the value of a backwater buddy who will pull you out of a scrape faster than a cottonmouth strikes.

One of Simpson's many gifts as a writer is an ability to intermingle literary references with names and events dropped from history and cozy it all up next to, say, the tale of an outdoor excursion with his wife and children. He does this effortlessly and without making a mess of the telling. Some sentences — sentences, mind you, not paragraphs, not pages — blend history, family, landscape, action and elements as incongruous as corporate hog farms and a Coca-Cola-gulping bear. And many of his jam-packed one-sentence paragraphs speak in a voice that seems to me a cross between novelist William Faulkner and my great-aunt Verlee, a mountain woman who could *talk*.

Even Simpson's personal stories are filled out with fact and fancy drawn from folktales and other peoples' lives. Reading his memories and reliving his exploits evokes my own recollections of the upper foothills, the Blue Ridge Parkway, Boone and Blowing Rock. His



clear pictures, unmucked from the dense sands of memory, pull into sharper focus my own buried treasures and the people and land from which they came. They will likely do the same for you.

The Art of Outdoor Photography: Techniques for the Advanced Amateur and Professional, by Boyd Norton (Voyageur Press, ISBN 0-8965-346-5).

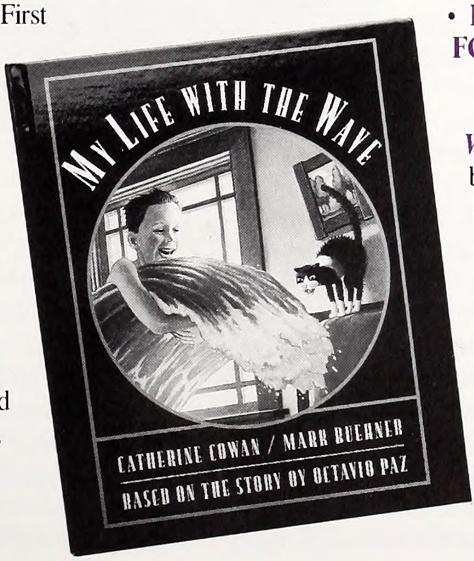
Whether you're a weekend shutterbug, an aficionado of spectacular nature photos or a professional photographer, *The Art of Outdoor Photography* should find a space on your bookshelf — and in your camera bag. First published in 1993, it debuted as a large-format, full-color paperback last year.

Norton, a former nuclear physicist, has photographed wild places and creatures since the 1960s. With work appearing in *Time*, *Audubon*, *Smithsonian*, *National Geographic* and many other publications, he packs substantial experience behind his advice.

His book is written not as a manual with step-by-step instructions but more as a conversation on capturing the outdoors on film. Accompanied by simply gorgeous photographs, the book covers the basics of lighting, lenses, composition, films and filters. Other chapters detail the special needs of shooting wildlife, landscapes, travel scenes, close-ups and underwater subjects.

Throughout the book, you'll find useful advice and even some self-assignments to complete. For example, after detailing the importance of mood, arrangement and other components of composition, Norton suggests reversing a photograph and studying how the "familiar becomes a little unfamiliar." By doing so, he says, a photographer can judge the scene afresh.

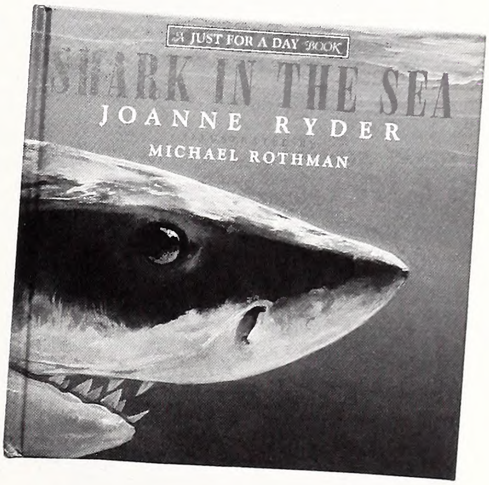
As a bonus, you'll live the life of a world-traveling nature photographer and visit such faraway places as Kenya, Norway, Borneo and Belize while Norton shares the techniques he used to produce compelling photographic records of these places. This personal approach makes *The Art of Outdoor Photography* a book not only to consult on occasion, but to read cover to cover at least once.


MY LIFE WITH THE WAVE
CATHERINE COWAN / MARK BUEHNER
BASED ON THE STORY BY OCTAVIO PAZ

• BOOKS FOR KIDS

My Life With the Wave, based on the story by Octavio Paz, translated by Catherine Cowan (Lothrop, Lee and Shepard Books, ISBN 0-688-12660-X).

A marvel of illustration and writing, *My Life with the Wave* is a treasure and a treasure hunt of sorts. The story of a young boy who adopts a wave as a pet explores the possibilities and limits of human compassion toward wild creatures. When the wave eventually asserts its true nature, it becomes a threat and a burden to the boy's family, and they eventually return it to the sea. The illustrations, by Mark Buehner, are vibrant and energetic. Parents as well as their kids will have fun finding the mice, seahorses, fish, whales, cats and dogs hidden throughout.



Shark in the Sea, by Joanne Ryder (Morrow Junior Books, ISBN 0-688-14909-X).

This installment in the "Just for a Day" series may be too intense for younger children because it does something it should do: realistically depicts a day in the life of a shark. Written in second person, it gives kids a chance to be a shark swimming, breathing, searching, and capturing and eating prey — a young seal. Neither the author nor the illustrator, Michael Rothman, hold back. Though poetic and beautiful, this book offers a gritty lesson in nature's ways. ◘

FOND
FAREWELL

A Dreamer and a Doer:

A Tribute to Kathy Hart

By Jeannie Faris Norris

It's 8:30 a.m., and Kathy Hart bustles into the North Carolina Sea Grant office. Her mind is already working on several communications projects. In fact, she probably started thinking about them in the shower.

By the time she's settled at her desk, she's planned the details of a new publication, made a mental list of phone calls and brainstormed a few ideas for *Coastwatch* articles.

For 18 years, that's how Hart started her day at Sea Grant. Last fall, however, she retired her professional crusade for the coast and began to apply her talents to her new job at Alumni Relations at North Carolina State University.

Sea Grant will miss Hart's unique gifts as director of communications. She was both ambitious and easygoing. She was a likable manager who always got the results she wanted. She was quick with a smile, a word of encouragement or a sympathetic ear.

Along the way, Hart amassed an irreplaceable wealth of knowledge about the coast, its people, its heritage and natural resources. Balancing responsibilities, deadlines and projects with the flair of an office acrobat, she constantly honed new and better ways to communicate everything from the latest water quality research to warnings against walking on dunes.

She once even loaded a group of national reporters onto a schoolbus and drove them to North Carolina beaches for an education on coastal science.

"Sea Grant is significantly better off, healthier and more productive because she was here," says B.J. Copeland, former director of North Carolina Sea Grant. "I think we made a lot of big steps."

Hart joined the North Carolina Sea Grant staff as a junior writer in 1979. Within five years, Copeland promoted her into the position of communications director. She shepherded *Coastwatch*, Sea Grant's flagship publication, from an eight-page single-theme newsletter to the longer, more varied magazine that it is today.

Coastwatch will likely stay the course that Hart envisioned for it, but North Carolina Sea Grant won't be the same without her. Nor will the national network of Sea Grant programs, which benefited from her ability to focus on the big picture, says Leigh Handal, one of Hart's closest colleagues and director of communications for South Carolina Sea Grant.

"I guess Kathy was like many other people in that she could always generate grand ideas in the shower," Handal says. "But what made Kathy special was that she would eventually get out of the warm, comfortable shower, dry off and make those ideas become reality. Kathy was a great dreamer, as many people are. But she was also a great doer, and that's a priceless combination in a colleague and a friend."

Copeland says Hart is one of the most determined people he's ever met.

"Her determination to produce things, her determination to accomplish things, her determination to be perfect," Copeland says. "She set very high standards for herself as well as for the things she produced. She was determined to make things better and to make Sea Grant a household word."

Then...

Herman Lankford

Hart made time in her schedule, already packed with projects, to take a leadership role in launching the Big Sweep waterway cleanup. She helped secure community support for the event, including a title sponsorship from First Citizens Bank, and she served on the cleanup's board of directors. Later, she chaired the board.

"I believe Kathy was instrumental in guiding Big Sweep to a higher level," says Executive Director Judy Bolin. "She's also very compassionate toward people, and she's very passionate about the environment."

... *and now.*

Cassie Griffin

Beyond the borders of North Carolina, Hart performed countless hours of extra service to benefit Sea Grant. She recognized that what programs can't do alone they can together. As a result, she emerged as a leader in the Sea Grant network of 29 coastal and Great Lakes programs.

She masterminded a national media relations office to advance the work of all Sea Grant programs. She led the network in writing a strategic plan for communications. And she was a driving force behind briefings for national media and policy-makers on the decline of fisheries (1995) and the emerging field of marine biotechnology (1997).

"Kathy recognized that Sea Grant was in a unique position to assist media in understanding coastal science," says Ben Sherman, Sea Grant's national media relations coordinator.

Never hesitant to try something new, Hart's efforts panned out. In 1993, after the Society of Environmental Journalists met in Durham, she led her famed field trip to the coast with national media. When they returned from their whirlwind tour, reporters from as far away as Los Angeles had witnessed a beach restoration in process and met Sea Grant experts on everything from coastal erosion to aquaculture to advances in the fishing industry.

"Kathy did much to vitalize the programs around the country," says Maryland Communications Director Jack Greer, who has observed Hart's rise above the ranks for nearly two decades. "It goes without saying that her enormous energy and considerable savvy will be sorely missed."

Hart even parlayed her love for the North Carolina coast and cooking into a book about both. She co-authored *Coastal Carolina Cooking* with former Sea Grant communicator Nancy Davis. The two researched the book from Currituck to Brunswick counties in the kitchens of 34 cooks who shared their recipes, traditions and their ways of life.

In many different ways, Hart made her mark on Sea Grant and the North Carolina coast. Her kindness and zest are sorely missed by her colleagues. And her contributions, easily measured by the boxloads of awards she packed out of her office, will be remembered in the standards of excellence that she left behind.

"I know I am a better professional for having worked so hard beside her," Handal says. "Kathy left me and the network better than she found us." ◘

A Lasting Legacy

Over the course of her career at Sea Grant, Kathy Hart contributed to the North Carolina program and the national network in ways both large and small. Some of her most successful projects are:

- *Coastwatch*, an award-winning magazine dedicated to the North Carolina coast;
- newsletters about water quality, coastal law, education initiatives, seafood safety and recipes, and commercial fishing;
- a media tipsheet of Sea Grant news;
- the popular Sound Facts newspaper series of illustrated briefs about the coast;
- two national forums on declining fish stocks and marine biotechnology;
- the successful North Carolina Big Sweep waterway cleanup;
- a World Wide Web site for North Carolina Sea Grant;
- a national media relations program for Sea Grant;
- a national strategy for the Sea Grant network to communicate the work of its agents and researchers;
- the HACCP alliance's seafood safety training manuals (see Autumn 1997 *Coastwatch*), among the most important and most-ordered publications ever produced by Sea Grant. ◘

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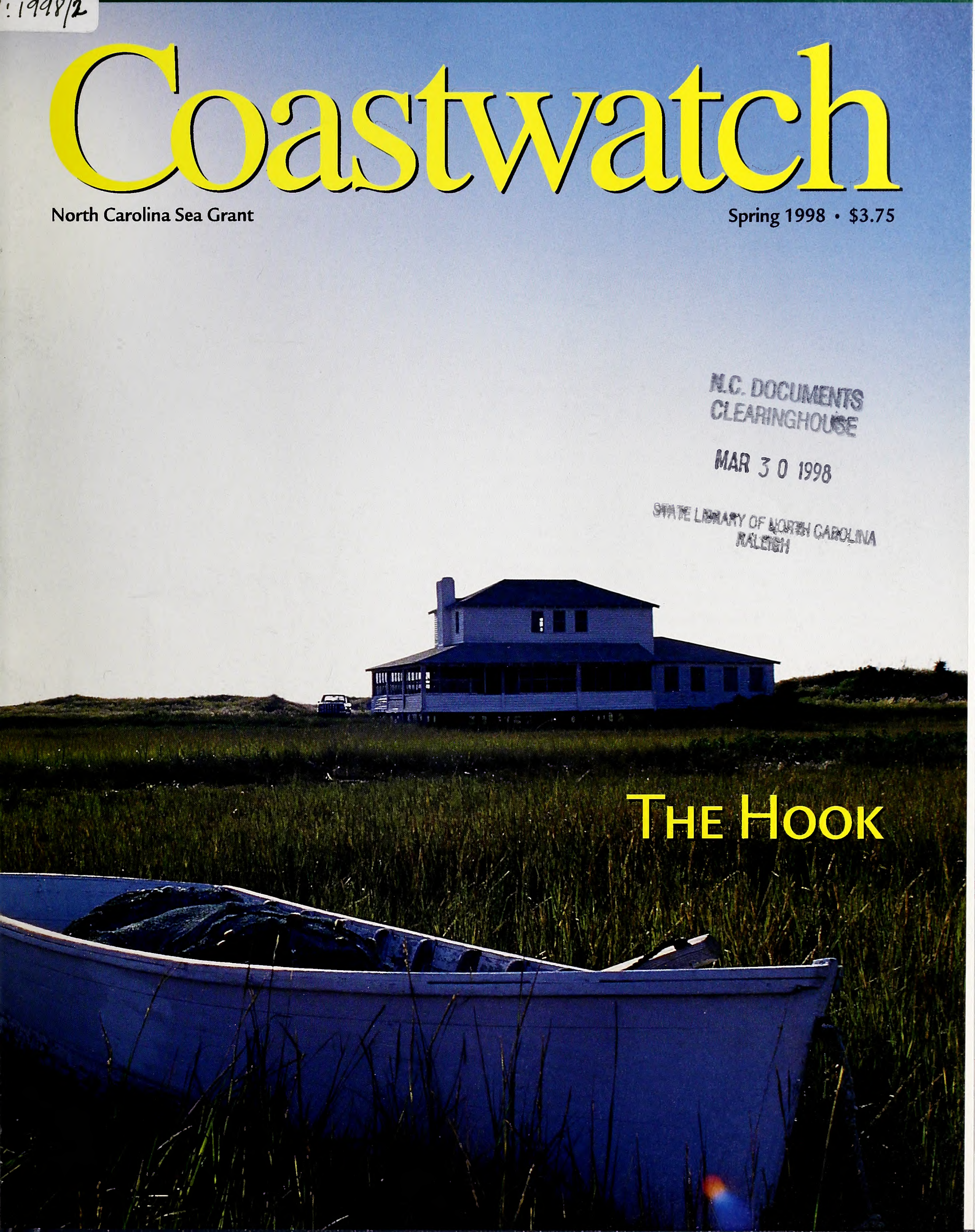

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From the Editors

The Ocean's Due

"Earth" is a misnomer for the planet we inhabit. If named according to the element most visible on its surface, Earth would better be known as "Ocean." Perhaps it is because humans are land creatures that we refer to our home by the solid ground on which we stand. If asked their preference for a name, whales might give a different answer.

But the ocean is as important to our lives as to the lives of bottlenose dolphins and snow crabs, bluefin tuna and loggerhead turtles. On an obvious level, we harvest creatures from the sea for our tables and use the water for recreation. Consider also that artists and writers create works inspired by the ocean's beauty and mystery. And scientists see it as a source of potential discoveries that could affect everything from medical technology to space flight.

With so much riding on the bounty of Earth's waters, keeping them healthy must be a priority. For that reason, the United Nations has declared 1998 the Year of the Ocean (see "Coastal Tidings" on page 3 for more information). Throughout this year, researchers and government officials, industries and concerned citizens will join together to give the ocean its due. How will we ensure clean waters and robust populations of marine species for the future? What are the many ways we affect the ocean, and how do we minimize our impact? The world will debate these questions and many more in 1998.

By its nature, North Carolina Sea Grant deals with marine-related issues every day, and the program is committed to addressing the problems the ocean faces. And for our part, we at *Coastwatch* plan to continue bringing you news of the ocean — this year and beyond.

This month, our stories highlight living by the water. We debut Eddie Nickens' series on North Carolina's coastal landmarks, those geographical places where land meets sea and man meets nature. Join him for a moving examination of living on "the hook." Odile Fredericks covers two issues important to life on the coast: building on urban waterfronts and encouraging tourism along the Intracoastal Waterway. And in "Naturalist's Notebook," Lundie Spence profiles the diamondback terrapin, a citizen of the salt marsh.

Unlike many land creatures, we have ways of leaving earth behind us and heading into the vast ocean. For centuries, we've reaped the rewards of this ability to take to — and from — the sea. Now, our challenge is to give something back. ◘

Jeannie Norris

Daun Daemon

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Eddie Nickens • Jeannie Faris Norris • Athena Osborne • Lundie Spence

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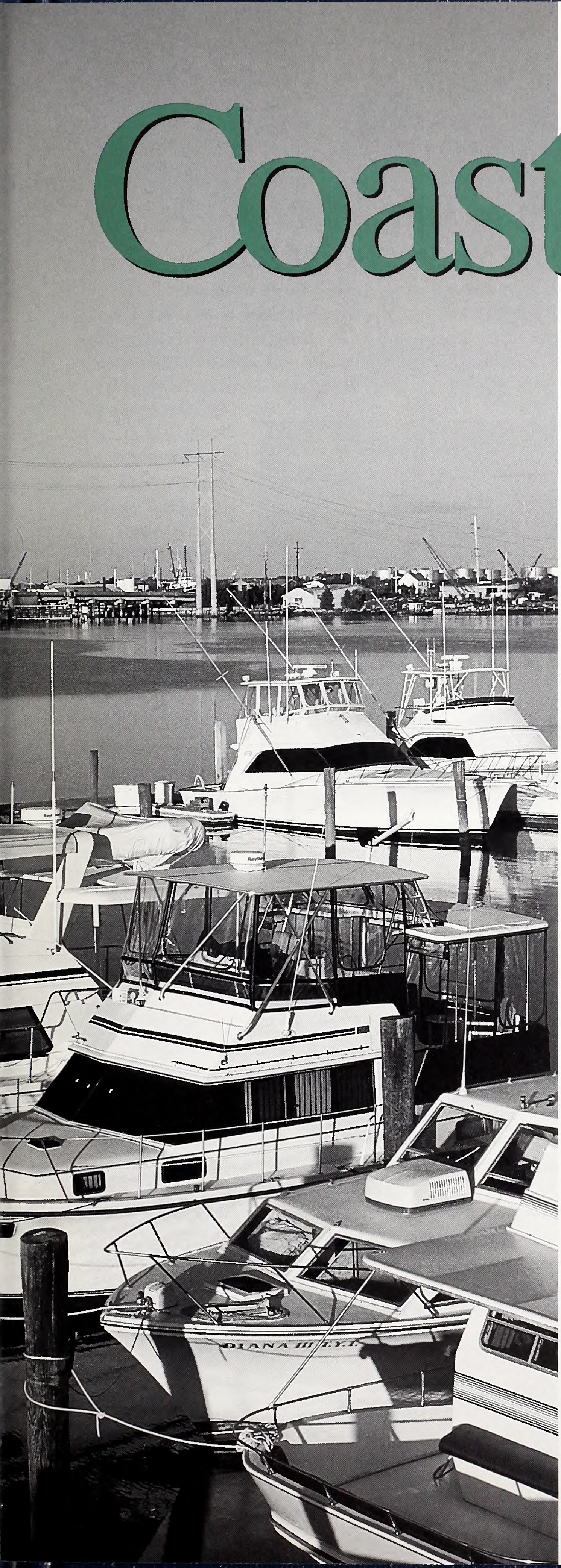
Coastwatch



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The Hook: Man's Tenure on Cape Lookout
Locals call it "the cape," and outsiders call it "the hook." No matter what you call it, Cape Lookout is a wild landscape of empty beaches, undisturbed marshes and rolling dunes. Few people, however, are aware that this remote cape of the national seashore was once quite heavily settled. 6

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is interim director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for $15 by the North Carolina Sea Grant College Program, Box 8605, North Carolina State University, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: faris@unity.ncsu.edu or ddaemon@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of Cape Lookout marsh and table of contents photo of Town Creek Marina by Scott D. Taylor

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COASTAL *TIDINGS*

Stay Tuned for *Pfiesteria* Documentary

If you've picked up a newspaper or watched the news lately, you've undoubtedly heard about *Pfiesteria piscicida*, the toxic dinoflagellate that's been linked to fish kills in North Carolina, Virginia and Maryland.

There has been no shortage of accounts about this organism. But stay tuned — in a matter of months, you can get the latest science-based information about *Pfiesteria* in a public television documentary. North Carolina Sea Grant is working with UNC-TV and the National Institute of Environmental Health Sciences (NIEHS) to produce a program about hazardous marine algae that highlights *Pfiesteria*. Scheduled to air on UNC-TV's *I.Q.* in late 1998 or early 1999, the documentary will feature hazardous algal blooms and their effects on human and ecological health. It will examine where and how often the outbreaks occur and how they relate to water quality.

Coordinating the program are Lundie Spence, Sea Grant's marine education specialist; Barbara Doll, Sea Grant's water quality specialist; and John Pritchard, chief of NIEHS' Laboratory of Pharmacology and Chemistry. They are working with a technical committee of scientists to guide the content of the show. — J.N. ◘

Cecil Hobbs

A microscopic view of *Pfiesteria piscicida*

In the Next Issue of *Coastwatch*

In the next issue of *Coastwatch*, Julie Powers takes you on a tour of Mattamuskeet Lodge, a structure with one of the most fascinating histories in North Carolina – and a new future. Built in 1916 as a pumphouse to drain Mattamuskeet Lake, this striking building was converted to a grand hunting lodge in the 1930s. Today, it has been rescued from decay and is being transformed into an environmental research and education center.

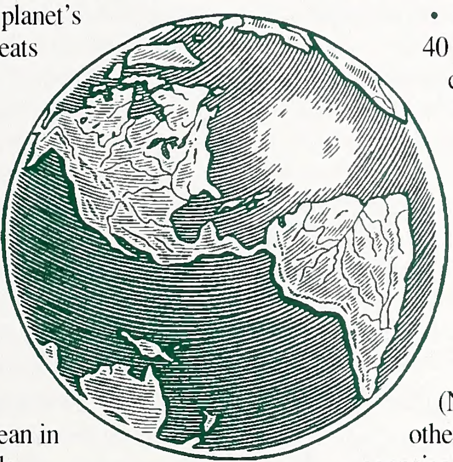
Kay McLain takes you on a tour of a different kind – a literary tour of the coast. She looks at the work of six contemporary authors who set their novels on the North Carolina coast and the environmental messages found in their writing. And she examines these authors' relationships with nature and the coast.

Also in the upcoming issue, Odile Fredericks looks to the skies for the subject of her article – lightning. North Carolina ranks second only to Florida in annual number of lightning strikes. What has the reign of bolts meant to life along the coast? ◘

COASTAL TIDINGS

1998 — The Year of the Ocean

Fishery declines, marine debris, coastal habitat destruction, oil spills, toxic algal blooms, marine mammal entanglement — the planet's oceans face these threats and many others. In recognition of the importance of marine resources, the United Nations has declared 1998 the International Year of the Ocean with the goal of increasing public awareness about the importance of the ocean in our lives. For example,



- more than 70 percent of the Earth's surface is covered by water;
- the total volume of Earth's oceans is 300 million cubic miles;
- the United States has more than 95,000 miles of coastline;
- more than one-half of the U.S. population now lives and works within 50 miles of the coastline;
- in the United States, 40 percent of new commercial development has occurred near the coastlines.

Watch for news about Year of the Ocean activities as the National Oceanic and Atmospheric Administration (NOAA) works with other federal and state agencies, industries, universities and environmental groups to promote relevant issues. NOAA has created a Year of the Ocean web site with pages devoted to education, community awareness and more. Check it out at http://www.yoto98.noaa.gov/. — D.D.

Center for Turtles in Trouble

You're taking an afternoon stroll on the beach when you notice a wounded sea turtle stranded on the sand. What do you do?

The Karen Beasley Sea Turtle and Rescue Center, a nonprofit organization that treats and releases injured and marooned turtles, can help. Located at Topsail Beach, the rescue center is managed by Topsail Turtle Project volunteers and funded solely by donations.

Jean Beasley, director of the project, says that a sea turtle in distress may exhibit any one of the following signs: It is beached or stationary, its movements seem lethargic, it is bleeding, or it is missing limbs or body parts.

If you come across a sea turtle in trouble, try to avoid frightening it. Approach the turtle from the rear and soften your light source if it is evening, Beasley says. During daylight, immediately shade the turtle from the sun's rays (a beach umbrella is ideal) and continually douse it with fresh ocean water. Then call the rescue center through the wildlife hotline at 1-800/662-7137. Sea turtles nest at night, so avoid approaching one at dark unless it is obviously injured.

The center currently houses three sea turtles, each named to identify the area where it was found and to which it will be returned: Corey, found at Core Sound; Kitty, found at Kitty Hawk; and Cee Cee, found in Carteret County.

For more information about the center, call 910/328-1000 or e-mail loggrhead@aol.com. Send donations by check or money order to Grace Murray, Treasurer, P.O. Box 3536, Topsail Beach, NC 28445. Make checks payable to "Sea Turtle Hospital." — A.O.

These Dunes Aren't Made for Walking

The season for sun and surf is approaching – finally. But in your rush to the beach, don't walk on the dunes or trample the dune plants.

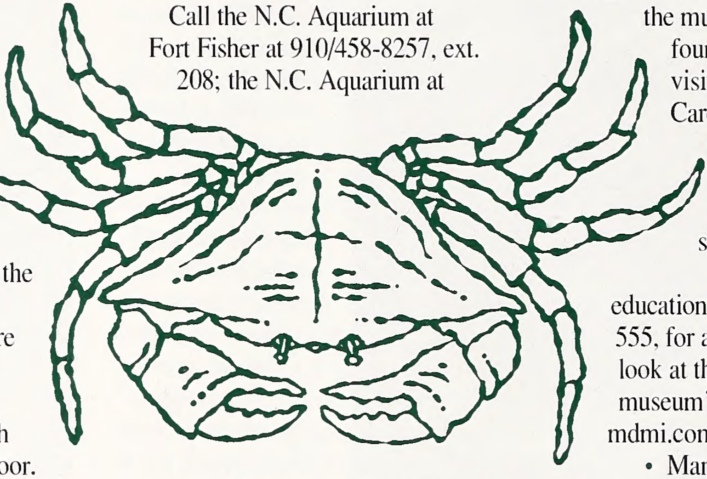
American beach grass, wormwood and eastern cottonwood are just some of the plants that anchor and stabilize our waterfront dunes. These dunes offer the first line of defense against wave action. If dunes are destroyed or breached, then what lies behind them, be it a wetland or a home, is vulnerable to the water's energy.

Although dune plants tolerate harsh conditions – wind, salt spray, overwash of waves, scarce nutrients, limited fresh water, intense sunlight and extremes of hot and cold – they can't withstand the pounding of feet and vehicles.

So remember, use crosswalks and designated beach access areas to cross the dunes. – K.H.

COASTAL
TIDINGS

Getting Back to Nature



Ever stand on the beach and wish you knew more about its flora and fauna? This spring and summer, our state parks, museums and aquariums are offering an impressive array of hands-on workshops and tours guaranteed to illuminate those natural splendors.

- At the N.C. Aquarium at Fort Fisher, spring workshops teach the art and fun of catching blue crabs and digging clams. For epicures who like some surf with their turf, the "how to" of surf fishing is on the calendar. If you're looking for more traditional aquarium classes, pick from programs highlighting the natural abundance of the salt marsh just outside the aquarium's back door.

The N.C. Aquarium at Pine Knoll Shores invites you to participate in the annual sea turtle release. Take a boat trip May 21, when staff members release sea turtles that have been temporary residents of the aquarium. Other programs offered this spring include salt marsh safaris, maritime forest hikes and canoe trips in the undeveloped Rachel Carson National Estuarine Research Reserve.

Experience a blast from the past at the N.C. Aquarium on Roanoke Island with classic videos featuring aquatic themes. On Friday, April 10, the aquarium will screen *The Mysterious Island, 20,000 Leagues Under the Sea, The Creature from the Black Lagoon* and *It Came from Beneath the Sea.*

The viewings are free with paid admission to the aquarium.

Call the N.C. Aquarium at Fort Fisher at 910/458-8257, ext. 208; the N.C. Aquarium at Pine Knoll Shores at 919/247-4003, ext. 123; and the N.C. Aquarium at Roanoke Island at 919/473-3494. Or check out the offerings for all three North Carolina aquariums on their website: http://www.aquariums.state.nc.us/Aquariums/.

- The North Carolina State Museum of Natural Sciences offers the Bird Rookery Bonanza, which gives you a chance to spend the weekend of May 15-17 at the Battery Island Audubon Sanctuary. This is an excellent opportunity to photograph large birds and their nests, eggs and nestlings at close range. Also, check out the Dismal Swamp Fern Foray on June 6, when you can witness the reproduction of the wild Wood Fern. (You'll also return home with a limited collection of spores for your own garden.) And if time is on your side, the museum will take you on a four-day trip to explore rarely visited parts of the North Carolina coast. You'll hike a deserted island, stargaze in the company of longleaf pine savannas and kayak a salt marsh tidal creek.

Call the museum's education secretary at 733-7450, ext. 555, for a registration form. You can look at the calendar of events on the museum's website at http://museums.mdmi.com/naturalsciences.

- Many of our state parks also hold classes. At Hammocks Beach State Park, for instance, spring and summer programs focus on everything from sea turtles and seashells to whales and jellyfish.

North Carolina state parks, recreation areas and nature preserves have wonderful programs throughout the spring and summer. To get a rundown of times and topics, contact the ranger at the park you'll be visiting. Or dial up the state parks' web page at http://ils.unc.edu/parkproject/progcal.html. It will give you the current calendar of events for all the parks. — E.B. ▣

Coastwatch Wins CASE Award

Coastwatch magazine recently was recognized with an Award of Special Merit from the Council for Advancement and Support of Education (CASE) in the District III (southeastern) region. The magazine won in the "Other Magazines" category, which recognizes excellence in magazines sent to audiences external to the university. The award is based on content, writing, editing, design, photography and printing.

Senior editors Daun Daemon and Jeannie Faris Norris stress that they will continue to improve the magazine for a general readership while pursuing the goal of supplying news about Sea Grant's research and extension activities. The focus of recent changes has been to shape *Coastwatch* into a magazine that reaches people at the coast and beyond with information about the natural and cultural resources, history, people and places of eastern North Carolina. ▣

Citizen Research

How does the shape of an artificial reef attract fish important to recreational and commercial fishers? Can a biodegradable latch in crab pots save crustaceans that crawl into lost or abandoned gear? Can bycatch reduction devices in commercial fishing gear be improved?

These are just a few of the questions North Carolinians have asked themselves about improving the state's fisheries resources. And they're a handful of the projects that have been funded for research through the Fishery Resource Grant Program.

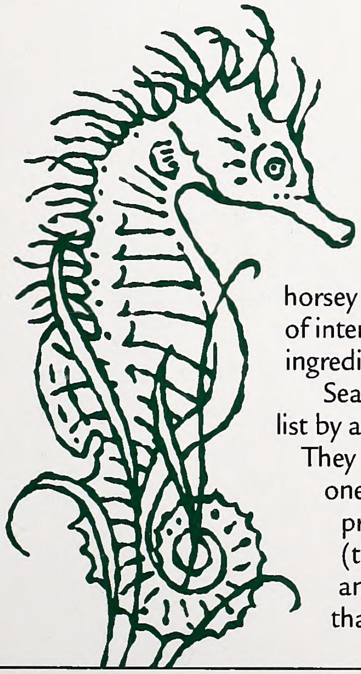
This year, 59 qualified applications will be considered for a share of $1 million available. The program, granted once a year by the legislature, funds qualified research ideas from people in the fishing industries. To be eligible, applicants must be involved in (or have the endorsement of individuals/companies that deal with) commercial or recreational fishing, aquaculture or mariculture, or seafood handling (seafood processors or dealers).

As the program enters its fourth year, research results from projects funded in 1995 and 1996 are beginning to come in. *Coastwatch* will share the outcomes of this citizen research as they become available. — J.N. ▫

Eating Like A Bird

Birds on the beach are always eating. They run, dart, peck and probe as they seek their next meal of beach fleas, sand crabs, worms and other invertebrates.

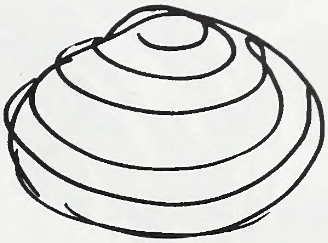
Like their feathered relatives, shorebirds have a high metabolic rate, requiring lots of energy to fly and to maintain a steady internal temperature of 101 F. To fuel their energy needs, birds must eat almost constantly. Scientists estimate that plovers eat 33 percent of their body weight every day. Smaller sandpipers must consume 55 percent of their body weight daily. Translated to humans, a 130-pound woman would have to eat 71.5 pounds of meat a day to rival a bird's consumption. — K.H. ▫



Sea Horse Populations in Danger

The whimsical-looking sea horse has long captured the fancy of writers in stories of fantasy. Unfortunately, the horsey sea creatures also have captured the interest of international traders, who harvest them as a key ingredient for Asian folk medicines.

Sea horses have been placed on the threatened list by an international conservation organization. They are vulnerable because they live primarily in one habitat – grass beds – where they are easy prey for traders. Sea horses pair off for life (the male carries the young during gestation) and, like mammals, have only a few offspring that they nurture until grown. – K.H. ▫



Mariculture Demonstration Project

North Carolina Sea Grant is a university program that brings the best in research, education and advice to the coast, finding answers for today's tough problems and anticipating tomorrow's needs. With an emphasis on cooperation, Sea Grant draws together resources and talents for projects such as the mariculture demonstration at Carteret Community College.

This project trains the next generation of shellfish and finfish growers through continuing education classes, and it serves as a mariculture research site for Sea Grant. The focus on teaching and testing ultimately benefits the industry and consumers by producing a cadre of talented mariculturists as well as innovations in growing shellfish and finfish.

Funded through the General Assembly's Fishery Resource Grant Program, this mariculture project has support from Sea Grant and the community college. And it's the first step toward fulfilling a cooperative contract between Carteret Community College and NC State University's Center for Marine Science and Technology. – J.N. ▫

The Hook

Man's Tenure on Cape Lookout

By Eddie Nickens
Photos by Scott D. Taylor

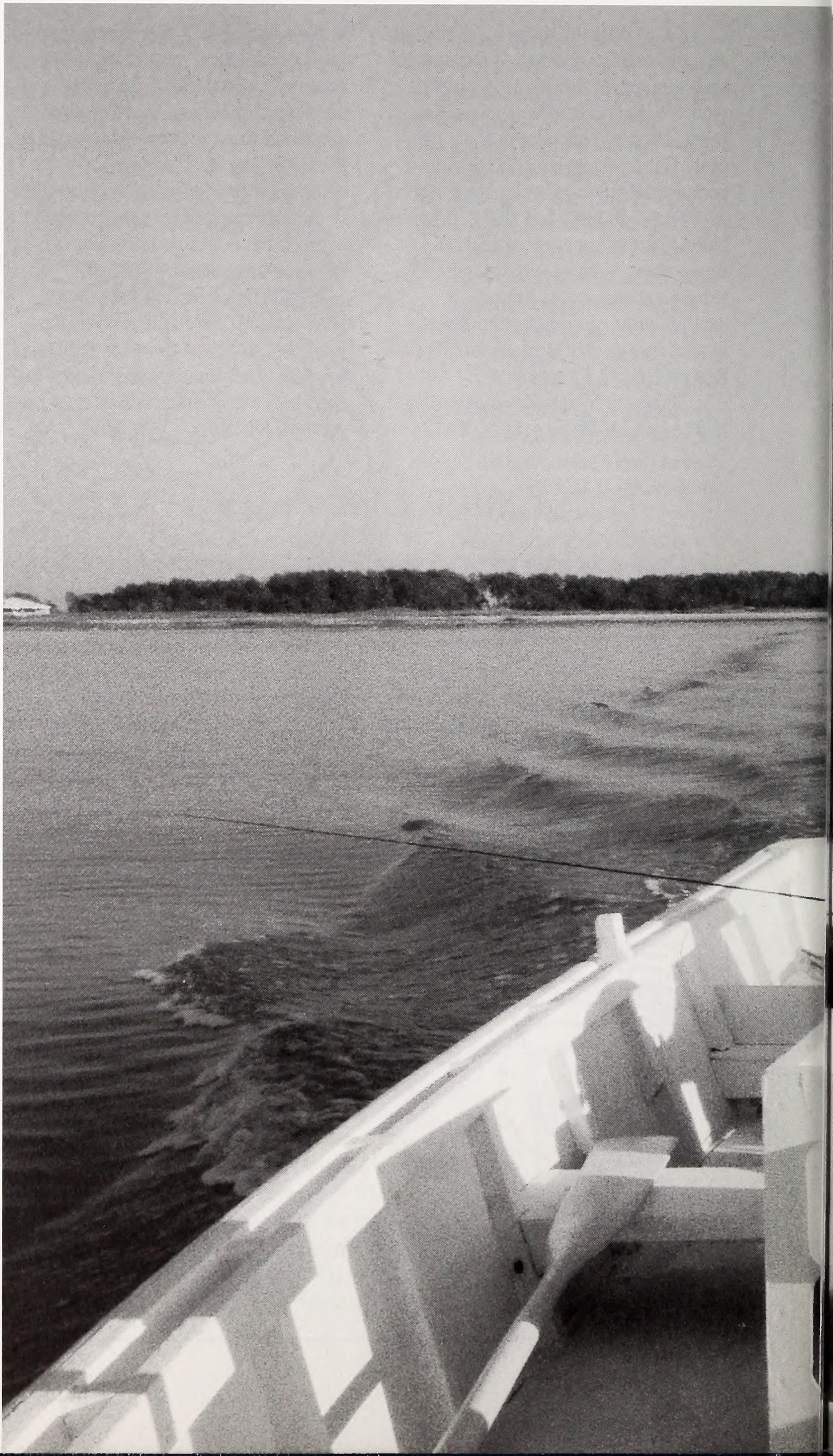
I am no newcomer to Cape Lookout National Seashore. In past years, I have overnighted in the rough-and-tumble Alger Willis fish camp, feasting on clams dug with a yard rake and red drum just hours out of the surf. I have camped in the fall under the beam of the diamond-patterned lighthouse and driven from Raleigh in the black of two-hours-to-dawn to fish the cape spit for false albacore and Spanish mackerel.

But never have I visited with a guide whose Cape Lookout pedigree is as pure as that of David Yeomans. Always before, I'd made the trip to exult in Lookout's wilds, its empty beaches and marshes and undulant dunes, but this time I hope to sift back through man's tenure on the cape. I hope to learn how its shores came to strike their fragile balance: not quite primal but far from tame.

Yeomans would know. He would know where the old whalers' camps had crouched in the dunes, remember the mailboat and recall lighting afire chips of dried cow dung so the acrid pall would hold the mosquitoes at bay.

Continued

This article is the first in a series by Eddie Nickens on coastal landmarks.



DAVID YEOMANS HAS SPENT HIS LIFE ON THE WATERS SURROUNDING CAPE LOOKOUT.

To most visitors, the lighthouse is Cape Lookout's image. They know little of the cape's communities, generations old.

He waits for me at the old U.S. Lifesaving Service boathouse he converted to a summer cottage 40 years ago. Within moments of our meeting, I learn why he wasn't born on the cape: The island had no midwife in 1921, so Yeomans drew his first salty breath on Harkers Island. He was boated home to the dunes of Cape Lookout. By the time Yeomans was born, the Cape Lookout Post Office had shuttered its windows (1911, after only 14 months in existence), the last whale had been killed there (1916) and the Lookout schoolhouse had closed (1919). But a vibrant little community remained tethered to the roadless, bridgeless island. And even though the Yeomans family had a house on Harkers, it stayed in the Cape Lookout camp three seasons out of four, going "off-island" only for Sunday morning preaching.

"I was raised right here to the cape," Yeomans says proudly, defiantly. He lived there until the age of 6, when he had to move to the mainland for schooling. But still he returned — weekends, summers, evenings after school and mornings before.

When I think of the cape, I think of its mazes of marsh creeks, of dune fields unscarred by roofline and rolling to the horizon, of meadowlarks calling from the scrub, of the tide pouring in over my bare feet and over the sand of the spit where pelicans huddle. But I think as well of Yeomans' blowsy face, framed with ears listing toward the overly large and a cockade of crew-cut hair white as an oyster shell. Hurricanes are etched in the wrinkles around his eyes and blazing August days writ in the dark blotches across his brow. I remember that he closes his eyes when he tells me about the square dances in the big house they called

Casablanca, out there on the moonlit bight, and when he speaks he moves his hands as if he were dancing. I remember that he draws his lips tight into a grimace and his forehead lines with a nervous furrow, times when I know he is thinking of the troublous four or five years to come, when his lease runs out on the Cape Lookout house he has loved and tended for 40 years.

I remember the last words he speaks to me, heartfelt as the slice of pear he hands me one day, the crescent of fruit balanced on a salt-corroded penknife blade. "You come back here," he says, as he carries the last of my gear to the ferry after three days of storytelling, net fishing and flounder gigging. "You got a place here. Anytime. Anytime."

And I wonder: How long will he?

Three barrier islands comprise Cape Lookout National Seashore, which cradles Core Sound off the mainland shore of Carteret County. From Ocracoke, the islands run northeast to southwest, in some places as narrow as a few hundred feet, rarely wider than a half-mile. South of Ocracoke Inlet is Portsmouth Island, 22 miles long from the haunting remnants of 18th-century Portsmouth Village to New Drum Inlet. Core Banks stretches another 23 miles to the checkmark-shaped "hook" or bight of the cape proper. Across Barden Inlet from Cape Point, a 3-mile-long spit angles sharply north-northwest, and the sandy elbow it forms cradles the tip of another island, Shackleford Banks, where forested dunes stretch 9 miles nearly due west to Beaufort Inlet.

When locals refer to Cape Lookout — the V of sand that is home to the lighthouse, the old Coast Guard station and remnants of the old Cape Village community scattered among the dunes — they call it "the cape." Outsiders tend to refer to it as "the hook." I meet Yeomans at the near geographic center of this hook, at the circa 1895 U.S. Lifesaving Service boathouse he'd renovated. It hums with activity.

"Most fish I've ever seen to the cape!" he announces at my arrival, beaming with equal parts exuberance and exertion. "Been that way all summer!" Two men mend net in the front yard; another cleans flounder. On a screened porch where dozens of old bottles line the walls, a single pedestal fan keeps warm air oozing over wet skin, and a woman in a bright pink warm-up suit plays solitaire. During spring and fall, someone is always coming or going at the Yeomans place, and even he can't keep straight whether two or three are going off-island today or tomorrow and when exactly the next four or five are due to arrive. "Come on in, come on, put your stuff down and let's go," he cries. "I'll take you anywhere you want to go, just tell me."

I drop a duffel bag and fly rod on the front porch and clamber into a four-wheel-drive pickup outfitted with wooden bench seats in the bed and oversized tires. A sandy trail runs in front of Yeomans' house down to the bight beach, and we grind across sand hard as concrete here and soft as meringue there.

Yeomans is short, wiry and excitable. In the last five years, he has had his left knee replaced with five pounds of stainless steel and his right hip replaced. But still, he crows, he gigged flounder last night from the bight beach nearly to the lighthouse and back "and never felt a thing!" As we churn through the dunes and scattered thickets of pine and myrtle, Yeomans tells me how he came to have a place of his own on Cape Lookout.

In 1958, the U.S. Coast Guard announced its intention to sell or raze several structures in the Cape Village community, so Yeomans bought the Lifesaving Service boathouse. He rolled it 500 feet north with two telephone poles and a pickup truck, pulling the structure a few feet, pounding the poles back into position, pulling again. The house now lies in a sandy swale behind dunes pocked with the remains of World War II machine-gun nests. To the north, a thick tangle of myrtle trees blocks the view to the bight, but this is a recent impediment.

Continued

CAPE BEACHES, POPULAR AMONG FISHERS, ARE RUTTED WITH TIRE TRACKS.

"When I was a boy, there wasn't no trees whatsoever," he says, and explains that from the early 18th century to the mid 20th, grazing cattle, goats and sheep kept the island's vegetation cropped.

For years, in fact, Yeomans could see out the back window clear to Harkers Island, where he was postmaster. Each afternoon he got off work at 4 p.m. and ran a 14-foot Barbour skiff across Back Sound, through Lighthouse Channel and Barden Inlet and into the cape bight. His wife, Clara, "would keep watch out to see me," he says, and when he got to a certain point in the sound, she knew it was time to put the dinner rolls in the oven.

Few people are aware that this wild cape of the national seashore was once quite heavily settled. To most visitors, the Cape Lookout lighthouse, built in 1859, is the park's image. Visitors by ferry arrive just a few hundred feet from the base of the lighthouse, and the Park Service visitors center is housed in the adjacent two-story brick lighthouse keeper's quarters. There, you can buy Cape Lookout lighthouse bookmarks, postcards and cross-stitch patterns, and view posters emblazoned with lighthouses in Maine, Florida, Wisconsin and Rhode Island. But you will learn nothing of the cape's communities of two generations ago and before.

When Yeomans was a child, some 50 houses were scattered through the dunes south of the light. They were the homes of fishers and surfmen for the Lifesaving Service mostly, but also of shopkeepers, at least one bootlegger and, later, of workers on the rock jetty built in the mid-1910s to stabilize the cape. Cape Village was one of several island communities, a minor one at that. Until a hurricane blew Barden Inlet open in 1933, Shackleford and Core banks were connected by a thread of dunes cut by "the drain," a low area where water trickled across at high tide. Yeomans remembers walking across the drain to Shackleford to visit the old cemeteries of a chain of abandoned, late 19th-century whaling towns — Diamond City, Wade's Shore, Sam Winsor's Lump and others that collectively accounted for perhaps 500 to 800 residents. But in 1899, a massive hurricane roared across the island, flooding homes and gardens, sweeping away cattle, killing orchards and breaking the bankers' will to remain. They sailed their houses across the sound board by board or in large pieces lashed to multiple skiffs. Within a few years, Shackleford Banks was deserted but for a few squatters' cabins, and today not a single structure remains there. But at the cape, the U.S. Lifesaving Service, folded into the Revenue Cutter Service in 1915 to form the U.S. Coast Guard, kept the community alive.

Yeomans pulls up to a low swale of marsh, and we step out on the narrow crescent beach of the cape bight. He points out a third of the 16 structures still standing in Cape Village. There are a few scattered one-story cabins with tin roofs and weathered walls, and the old Casablanca house, its screen porches lending it a snaggletoothed appearance. The most prominent structure is a two-story building with cedar siding weathered to gray, hovering close to the water with a regal bearing. It had been the old lighthouse keeper's quarters, built in 1907. In the same year that Yeomans moved the Lifesaving Service boathouse, Graham Barden Jr., son of the longtime congressman for whom Barden Inlet was named, bought the house with two friends and moved it from the lighthouse to the bight. "We basically bid what it would cost to raze the house and haul away the debris, which is what the Coast Guard planned to do," Barden says. "They said flat out they wanted a raked-clean lot."

Now the National Park Service owns the houses, and most are leased to their former owners. In the early 1960s, the federal government considered extending the Cape Hatteras National Seashore south to Shackleford Banks, and by the summer of 1963, the state of North Carolina had purchased 80 percent of the barrier island

FISHING IS AN AGE-OLD LIVELIHOOD ON THE CAPE.

LONGTIME RESIDENTS REPRESENT A CONTINUUM OF HISTORY ON THE CAPE THAT REACHES BACK AT LEAST TO THE EARLY 18TH CENTURY.

property between Ocracoke Inlet and Cape Lookout, with plans to transfer the land to the National Park Service. When the Cape Lookout National Seashore was established as a separate park unit in 1966, Cape Village property owners suspected that sooner or later they would have to sell their land, either willingly or through order of the courts.

Yeomans struck his deal in 1977: He sold his cabin but kept a 25-year lease to occupy the house. A handful of the other property owners on the cape did the same. Unless their leases are extended, they all will have to abandon the island in the next decade or so. "Congress has already spoken as to how we should manage the seashore," says Bill Harris, the Cape Lookout National Seashore superintendent. "We've held up our end of a fair bargain."

Even though the property is paid for and it would take an act of the U.S. Congress to extend or renew those leases, the specter of these long-term leaseholders loading up their belongings for the last time angers some locals. Their presence represents a continuum of human history at Cape Lookout that reaches back at least to the early 18th century.

Such a link to the past will be difficult to sustain once the few Lookout old-timers are gone. Already many locals hold the Park Service liable for what they consider the whitewashing of Core Banks' human history. Harkers Islanders still talk about the day the Park Service burned their squatters' camps on Shackleford Banks, camps some had used for generations with few questions ever raised about their right to be there. Throngs of people gathered on the Harkers Island shore, looking over the sound, weeping as the smoke rose three miles away.

"You go to the Park Service (visitors center), and they have pictures of turtles and piping plovers and crabs," says Karen Amspacher, director of the

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YEOMANS' HOME IS A HAVEN TO FRIENDS AND FAMILY WHO WANT TO ENJOY THE QUIET AND BEAUTY OF THE CAPE.

Core Sound Waterfowl Museum. "But there's not a sign, not a marker, not a trail, not a nothin' to tell about the Hancocks and the Willises and the Guthries of the banks."

Yet few could deny that the National Park Service has faced a Sisyphean chore on these embattled islands. By nearly all accounts, parts of Core Banks were literal dumps when the national seashore was established. The Park Service hauled away more than 2,500 abandoned cars, trucks and bread wagons jerry-rigged for surf-fishing. Sandy four-wheel-drive roads had churned across fragile vegetation and carved gaps in the protective dunes that allowed storm tides to wash across the island. More than 340 structures, many merely tar-paper shacks, were removed by their owners or destroyed by the Park Service.

Now, as the rest of the Outer Banks is transformed into a homogenous strip of shopping centers, restaurants and resorts, Cape Lookout bears the burden of being many things to many people. It is a wilderness preserve, fishing destination, campground, historic district and nursery for terns and sea turtles. And though lack of road access keeps visitation far below that of Cape Hatteras, its sequestered setting makes it even more attractive to those who visit.

More visitors create greater demands, and just as Park Service managers get a handle on balancing fishers and turtles and plovers and beach buggies and shell-seekers, new user groups crop up with new concerns and needs. The banks' sheltered waters and sprawling marshes attract squadrons of sea kayakers out for a half-day or a week of base-camping in the dunes. And the explosive growth of saltwater fly-fishing has, in the space of a few years, turned the waters off the hook's rock jetty and Cape Point into a parking lot for boats, a place where sportfishers pay guides $350 per day to cast $5 flies to schools of migrating false albacore.

The next morning, I hitch a ride with Michael Rikard, the park's natural resources manager, whose job is to see that recreational uses don't negatively affect the park's preservation mandate. In a few weeks, Rikard tells me, the Cape Point will be packed with trucks. But even with the fishers and the growing numbers of daytrippers, 50 miles of sand makes for a pretty effective buffer. "If you compare us to Cape Hatteras," he says wryly, "then we're a sleepy little park with no problems."

We drive along the single two-track sand road that threads the island's spine, watching peregrine falcons pirouette in the morning updrafts. Many visitors might describe Cape Lookout as a stark landscape, but on this morning it is anything but. Fire-wheel flowers speckle the lower slopes of the dunes with their brilliant orange and yellow bull's-eyes. The truck groans through soft sand as it climbs the dune line and coasts onto the beach, and the empty stretch of sand seems to invite Rikard to play the Park Service's ultimate trump card in any discussion of its management of Core Banks and the cape: the undeniability of what the future had in store for Lookout were it not for public ownership. The choice was clear: Look at Bald Head, Figure Eight, Atlantic Beach, Wrightsville. "We could have had that here," Rikard says, his words freighted with the feel of a closing argument.

Among Rikard's chief directives is the complicated allocation of the banks' precious sand beaches to all who vie for them. Federally protected sea turtles nest on the beach, as do endangered piping plovers and vast numbers of terns, oystercatchers and other shorebirds. Many of these species are at the fringe of their natural range here, so climatic factors may help explain nesting success rates that are far lower than elsewhere. The islands also have lost their suite of natural predators — the foxes are gone, and bobcats are few or nonexistent — so the population of egg-loving raccoons has exploded.

Yeomans and his wife, Clara, have made their home at Cape Lookout in a converted Lifesaving Service boathouse.

But other denizens of the beach weigh heavily in Rikard's calculus of environmental impact. Few sights are as surprising to the unsuspecting visitor as the trucks, vans and campers at the water's edge. Despite outcries that beach driving crushes turtle and tern nests, carves ruts that make it difficult for hatchling loggerheads to crawl safely to the water and disrupts feeding birds as well as beachcombers seeking refuge, the Park Service allows driving on 90 percent or more of the Core Banks beachfront. Rikard insists that these human impacts are well managed with specific beach closures during nesting and foraging seasons and a daily turtle patrol during the sea turtle nesting season.

If nothing else, these vehicles are a nod to the traditional uses of Core Banks and offer compelling evidence that the National Park Service, though despised by locals as an oligarchy that rules from its headquarters on the eastern end of Harkers Island, worked hard to meld local concerns with its national priorities for preservation and wilderness. An early draft for the national seashore even called for intensive park development along much of the islands, including large campgrounds and slips for hundreds of boats on Shackleford Banks and a dredged boat channel down the entire soundfront of Portsmouth Island and Core Banks. Those plans met stiff resistance from locals and were shelved.

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No matter. Ill will toward the Park Service is still legendary in the neighboring communities. Rikard's perspective is stoic. "Until you get past a few generations," he says, "there will be great animosity."

Standing in the surf the next afternoon, alone on miles of sand, I cast a fly toward a school of pompano scattering tiny baitfish from the top of small ocean swells. Up the beach, another group of fishers works the water, but at a distance that makes them appear as ants on the sand. As far as I can see beyond them, there is no high-rise hotel, pier, T-shirt shop, boardwalk, beach house, billboard, snow-cone shack, hot dog stand, private beach club or restaurant, and I know that beyond my scope of vision none of these mar the beachfront for mile upon blissfully desolate mile. Thirty feet away the waves curl, and at the aquamarine apex of each, just before it breaks, the pompano flash like diamonds. When one takes the fly, 2 inches of red-and-white chenille tied to a stainless steel hook, the rod dances in impossibly deep arcs for such a diminutive fish.

At such times it is difficult to argue with the logic of preservation. Along the North Carolina coast are too many places where the lessons have been hard on the soul. In my lifetime alone, there was the close call at Bald Head Island, nearly purchased by the state in the 1970s but now carved up into half-million-dollar lots, and the slow death spiral of Currituck Sound and Banks, once legendary among hunters and fishers.

But three days with one of Lookout's last natives brings into sharp relief the sacrifices required to ensure that this stretch of beach will remain wild. Some question why current leaseholders should make a private retreat of public land, and their argument has weight and substance.

And yet, as I shuffle alongside Yeomans in the gnat-filled marsh edge at night, a flounder gig in my hands and a flounder light in his, and hear his tale of being towed behind the mailboat out to the drain when he was a boy, years before Barden Inlet opened, and filling his skiff with clams, I feel the blessing of the real and the true and the last of its kind. Blessed I am to hear old island ballads sung by men who recall them from youth. Blessed to learn how to gut a flounder from someone who learned from his daddy, and he from his daddy, and he from his — fishers all.

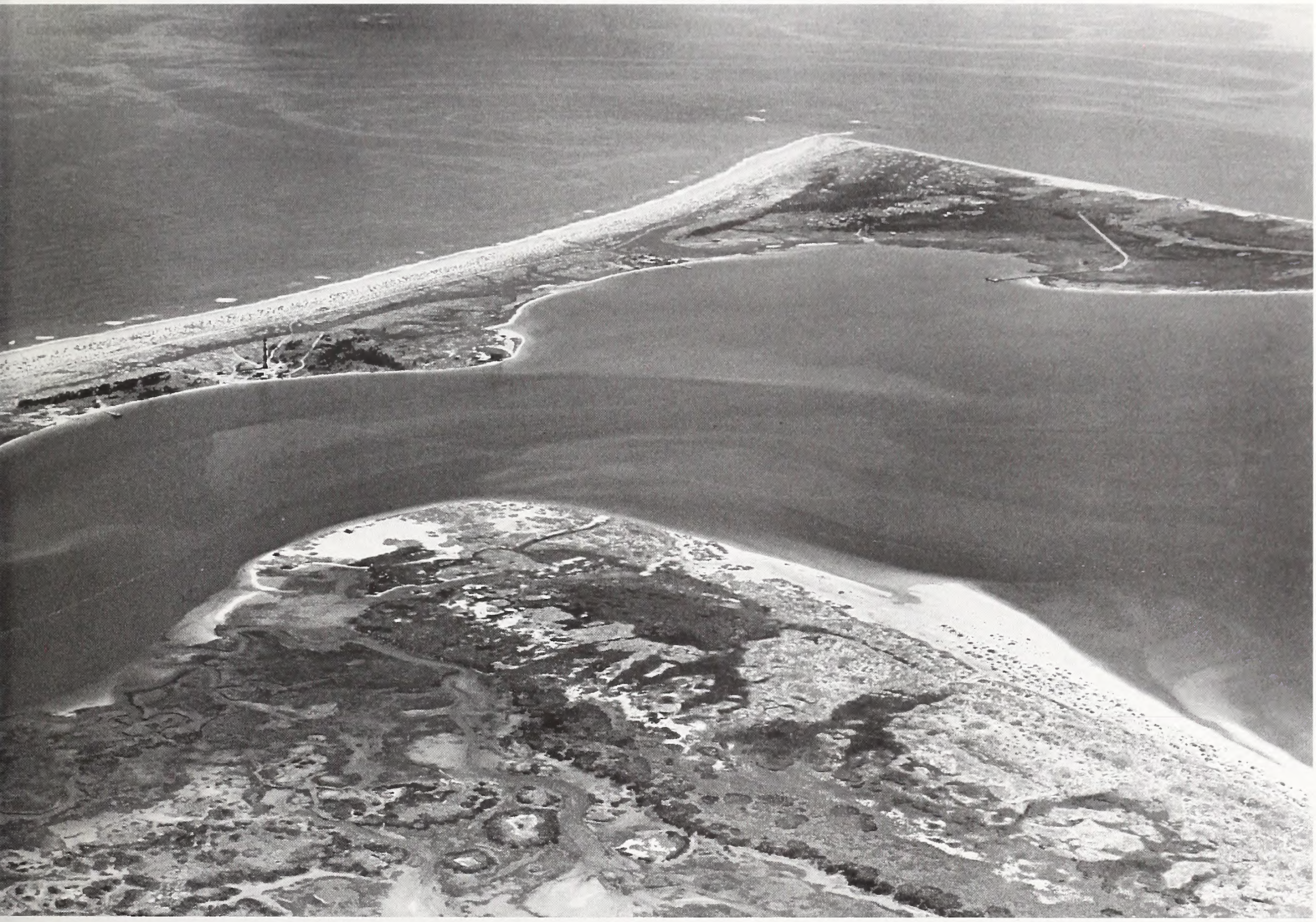
When the last of the Lookout natives are gone, the cape will be a wilder shore, perhaps, but it will lose more than footprints in the dunes.

I know that I will find it impossible to walk those empty dunes again without seeing ghost images of a young Yeomans, or without wondering where the whale lookouts were posted, or if the Lifesaving Service surfmen ever dragged a drowned sailor to the beach where I parked my truck, or how it would feel to square dance in a salt breeze.

One image is no ghost at all. Early one afternoon on the Lookout bight beach, a crew of commercial fishers working a 700-yard long-haul net pull ashore an enormous catch of fish. When word of the bonanza spreads among Cape Village, a half-dozen people pile into Yeomans' truck for the ride to the bight. Most of the hard work is finished when we arrive, the circle of net taken in bit by bit, corralling the fish into a smaller and smaller web, but still the fishers haul in the last of the net by hand.

Inside it a mass of fish swarm like angry bees. The fishers had hauled through a school of spot, but there is more. Spanish mackerel slice the water,

THE SPIRIT OF COMMUNITY ON THE CAPE HAS ENDURED FOR GENERATIONS.



An aerial view shows the checkmark-shaped hook of Cape Lookout.

sides shimmering like wet opals. There are gray and speckled trout, pufferfish, croaker and skates. Without hesitation Yeomans and the others wade into the water, helping to keep the floating edge of the net from sinking with the weight of fish and to keep the sinking edge, weighted with hunks of lead, from bowing up from the bottom and allowing fish to wriggle free.

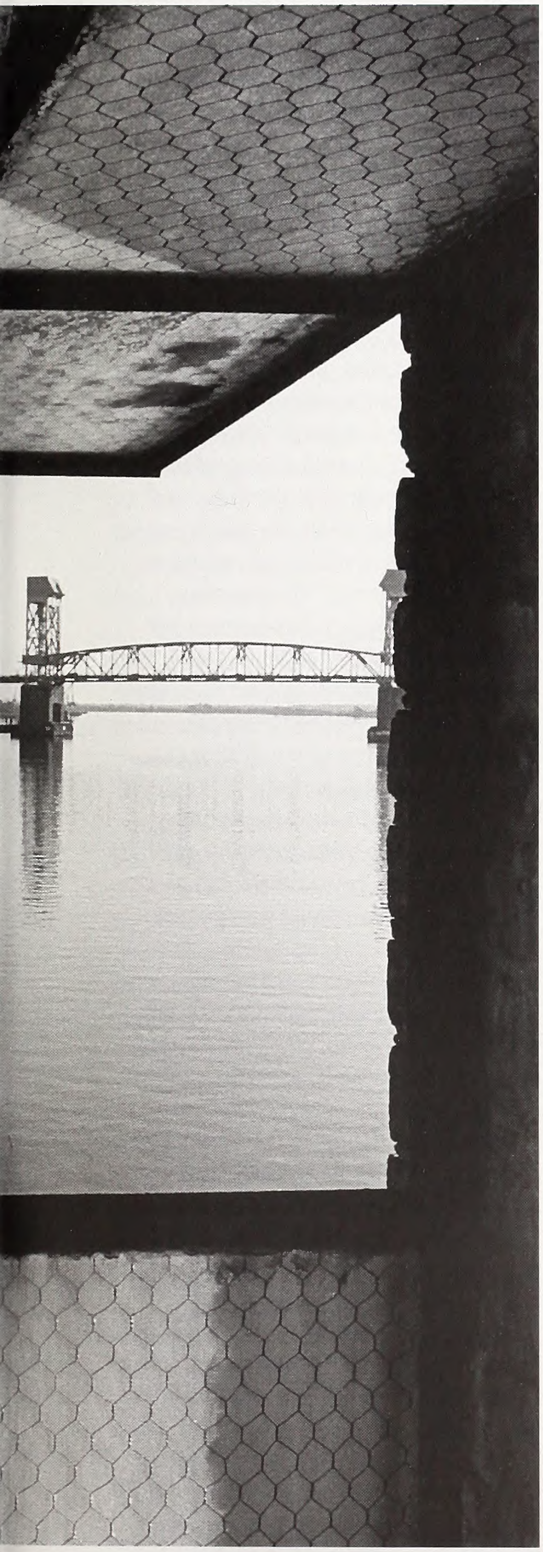
For a few minutes I work beside them, but then I slip away and step back up to the beach, suddenly aware that this is a moment to which I do not belong, except to bear witness. Quietly I watch the old bankers haul net together on the Lookout bight beach — Yeomans with his hand on his deaf wife's shoulders, her hair in a powder-blue hair net; and Madge Guthrie, whose mother was the last teacher at the Lookout school and who recalls dropping off to sleep in a little shotgun house on the cape as the lighthouse beam washed across her bedroom windows. When one of the fishers scoops a small sea turtle out of the net and releases it into the open water, Guthrie screeches, only half-kiddingly: "Oh, no, put 'im in a pot with spring onions and airsh potatoes! Oh, come back!"

All the crowd roars, and I see that time has suddenly turned back for them, each of them who would tell you with grim faith that their memories of the cape keep them alive as much as breath itself. They cackle with glee at the swarming fish and holler out to the watermen stacking net in an old wooden boat, "Way to go, boys!" and "That's some fish, ain't it? What you reckon, ten thousand pound?" And as the buy-boat waits in the bight to transport the catch, they gather round for perhaps the last time in their lives, hauling a net pulsing with fish and the slippery fragments of their own memories in the cape's clear waters. ◘

SHAPING

The southward view from Gene Merritt's building in Wilmington reveals the potential for waterfront development.

THE WATERFRONT



New Law Allows Building Over Public Waters

By Odile Fredericks

When Gov. Jim Hunt inked House Bill 1059 into law last summer, environmentalists saw red, developers saw green and everyone seemed sure they would never again see North Carolina's urban waterfronts the same way.

With the scratch of a pen, the waterfronts appeared alternately destined for environmental destruction or poised for the glorious rebirth of their maritime pasts.

For better or worse, the legislature amended North Carolina's 23-year-old Coastal Area Management Act (CAMA) so that state regulators now are required to issue permits for certain kinds of development over public waters. Gone is their discretion to deny them. Suddenly, the power to determine the environmental impact of these projects lies in the hands of local municipalities rather than with the state Division of Coastal Management.

Months later, the media outcry has died away. Yet, urban waterfronts never rang with the crescendo of construction sounds expected after the legislation passed. And with a three-year limit placed on the law, its impact on the landscape remains to be seen.

The law that was expected to reshape North Carolina's waterside districts sprang from developers' frustrated efforts to build along Wilmington's historic waterfront and over the Cape Fear River. Three years ago, Gene Merritt, a leader of the city's South Water Street Development Team, tried to get approval to build on historic South Water Street between Market and Nun streets.

Private owners in that three-block stretch previously had been approached by the city of Wilmington, which was interested in expanding the riverwalk southward along those blocks and revitalizing the area, Merritt says. The city had built the northern stretch of the riverwalk with ease because it lay within city or government property, but it needed private landowners' permission to move south, he recalls.

The private property owners then decided they wanted to build restaurants, shops and residences. At that time, however, the Coastal Resources Commission prohibited the construction of non-water-dependent structures, such as those being proposed, over public waters. Put simply, marinas and docks were allowed — the other types of buildings were not.

Tired of waiting more than two years for a rule change from state regulators, Merritt took the developers' case to New Hanover County Rep. Thomas Wright, who sponsored a bill to amend CAMA. The bill was intended to revitalize only historic waterfronts, but as it moved through the state Senate, the wording broadened to force state approval of urban waterfront development within not only historic waterfront areas, but also central business districts.

As a result, the law is expected to affect cities up and down the coast and on nearby rivers and inlets. Several municipalities — Wilmington, Manteo, Swansboro, Washington, Beaufort, Morehead City and Elizabeth City — have expressed a general interest in

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prospective waterfront development to the Division of Coastal Management. Yet, by early February, they had not applied.

Plans are under way for construction in the South Water Street district, Merritt says. The city of Wilmington is preparing an overall plan for the district — including the riverwalk, shops and restaurants — that is expected to be presented to the Division of Coastal Management early this year.

Merritt surveys the Wilmington waterfront from his building.

"The funny part about it is that you're not talking about very much land," Merritt says, referring to proposed South Water Street development. "You're probably talking about a maximum of four to five buildings, but you would think we were trying to build the Brooklyn Bridge."

Once complete, the development will give the public something it hasn't had before, says Wilmington Assistant City Manager Michael Hargett.

"The land is in private hands, so through this cooperative effort, the public would be afforded contact with the river in an area with high demand for pedestrian access to the water."

Even environmentalists agree that the Wilmington developers' plan is not a threat to the environment.

Pricey Taylor, a member of the Coastal Resources Commission, the policy-making arm of the Division of Coastal Management, describes the Wilmington plan as a good one, designed to revitalize an abandoned waterfront. However, she says, the stage is now set for environmental abuse under the new law.

"Part of the way the law reads (is that) the cities and local government agencies can determine environmental impact of the proposed development," she says. "It's scary to think the local government is going to decide if a proposed development has an environmental impact or not, particularly when the alternative is increased tax revenue."

City officials like Hargett maintain that they will be vigilant.

"We believe that there are sufficient restrictions to limit the type of development that occurs," he says. "The city of Wilmington is certainly committed to utilizing those provisions to ensure the development is suited to the location."

The law, in effect, has removed certain projects from CAMA standards designed to protect the environment, says Robin W. Smith, state assistant attorney general and counsel to the Coastal Resources Commission.

"(The Division of) Coastal Management has some fairly specific development standards that apply to activities in public trust waters — activities ranging from pier construction to dredging and excavation, and many of those standards, which have been fairly developed over the last 20 years, simply cannot be applied."

It's a concern echoed by the Army Corps of Engineers, the federal regulatory agency that also oversees such development. Until the law passed, the corps and the Division of Coastal Management jointly issued permits to save time and avoid duplication. With the state agency's hands now tied so that it can no longer reject certain permits, the corps has reverted to issuing its own permits for urban waterfront development and is doing its own environmental assessments, says Wayne Wright, chief of the corps' regulatory division for the Wilmington district.

"Very frankly, there are not many local governments that are really qualified to evaluate that (environmental impact) adequately, at least for federal purposes," he says.

Since the 1980s, corps headquarters had encouraged its agencies to rely on a state permit program, when one existed, that would adequately cover the corps' environmental and navigational concerns.

"This legislation, in this particular instance, forces us to reject that process for this type of development in the future and to require separate permits because the state is no longer able to take care of our concerns," Wright says.

At the Division of Coastal Management, Director Roger Schecter points out that the division and the Coastal Resources Commission support the concept of redeveloping waterfronts.

"Urban waterfront redevelopment has always been a good use of a waterfront," he says. "The difficulty has been the balancing of public and private uses of and access to the waterfront."

He says that while the division is no longer able to deny a permit for certain development over water, people still have to apply for that permit and they have to meet conditions set out in the law. The law also doesn't exempt them from other types of permits, such as a 401 water quality certification from the Division of Water Quality.

Nevertheless, the move to individual permitting is a step backward, says Walter Clark, ocean and coastal law specialist for the North Carolina Sea Grant College Program.

"It's moving away from what we've been trying to do over the years in making things easier for permittees by trying to limit the permits they have to get," he says.

Developers now can expect to wait an average of 110 days for the corps' approval under the split process compared with the previous 60-day period under joint permitting.

And the door is open for conflicting state and federal permitting decisions, Smith says. A project could be approved at the state level under CAMA but denied by the corps under its Rivers and Harbors Act of 1899, which covers structures in navigable waters.

The corps' stance may account for the quiet on the waterfront. Besides doing its own review, the federal agency says it plans to continue its policy of prohibiting permanent enclosed non-water-dependent structures over navigable waters, with few exceptions.

"We haven't had any contact at all from any other municipalities that are proposing to do anything under this bill at the present time," Wright says. "My feeling is that they're kind of waiting to see what's going to happen with the Wilmington situation."

Wright says he has had discussions with the Wilmington developers but has not yet seen their proposal on his desk. If they are proposing permanent structures on the water, he says his office would like to help them look at how the buildings could be shifted away from the water.

At issue in the debate is a desire to protect the environment and to ensure that the public continues to have free access to the water. After all, Clark says, those waters and the land under them usually are owned by the public and the state.

So far, the state has allowed private use of public waters only to give landowners access to the water, for example, to dock their boats or when the state receives compensation, as from shellfish farmers.

While the issue of public access may seem esoteric, regulatory agencies say it is not. As more municipalities and entrepreneurs rediscover abandoned waterfronts as a source of revenue, regulators say they want to ensure that simple pleasures like strolling along the waterfront or swimming, boating and fishing remain free to everyone.

"The real crux of the debate is whether it's necessary to allow private, non-water-dependent development over state-owned navigable waters to successfully revitalize urban waterfronts," Clark says. "Or, can you have quality waterfront development that is exactly that — development that stops at the water's edge?"

Wright says no one yet knows how the law will shape development in coastal and riverside communities.

"We won't really know until we get into it to find out if any of these municipalities feel they have to have those kind of permanent non-water-dependent structures," he says. "It may be many municipalities can develop their waterfronts ... simply (by) using platforms or walkways, which we can normally permit."

That idea may not wash with developers who say that North Carolina has a history of non-water-dependent retail commerce at its ports. For them, restoring the waterfronts to their former grandeur goes hand in hand with catering to customers at the water's edge.

For his part, Wright, the state lawmaker, says he sponsored the bill for the greater glory of Wilmington, which at the turn of the century was an "economic mecca" for the state. Before the law passed, he says restrictive state rules prevented the building of restaurants and inns in places where tourists may want waterfront property.

"You can't have people come visit you if there's nothing to entertain them with," he says. "We're one of the fastest-growing coastal areas in the state. I'm tired of folks coming here and there's nothing for them to do, so they all head south to Myrtle Beach. We lose the revenue. It's about business." ◘

Wilmington's lively waterfront could extend southward.

Luring Boaters to Waters Less Traveled

By Odile Fredericks • Photographs by Scott D. Taylor

North Carolina may be reeling in a whole new catch from the Intracoastal Waterway if the newly formed Coastal Waters Heritage Tourism Council has its way.

The council plans to capture the shoals of boaters who normally bypass North Carolina coastal towns as they paddle, motor and cruise the waterway. One bait being cast are water trails that lead to historic and cultural sites in towns such as Edenton and New Bern. Another under consideration is simply an offer of more amenities for boaters, such as slips or parking spots where they can hook up to utilities.

Boating tourism is an undertapped market in North Carolina, says David Little, state director of tourism development. The council, an independent nonprofit corporation, was formed more than two years ago to prepare a regional plan for water-based tourism. Intercepting boaters on the Intracoastal Waterway seemed an obvious way to garner income for the state.

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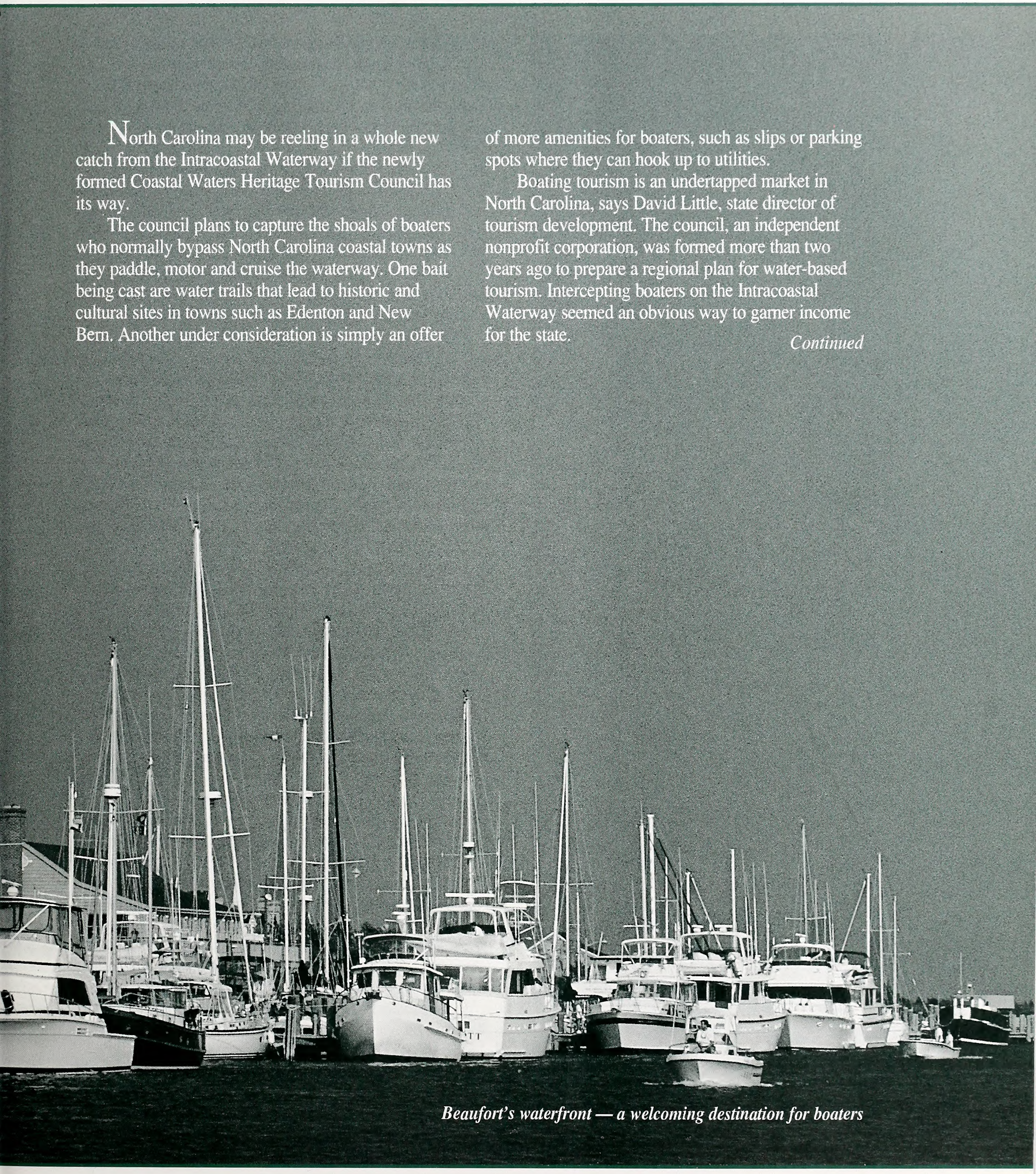
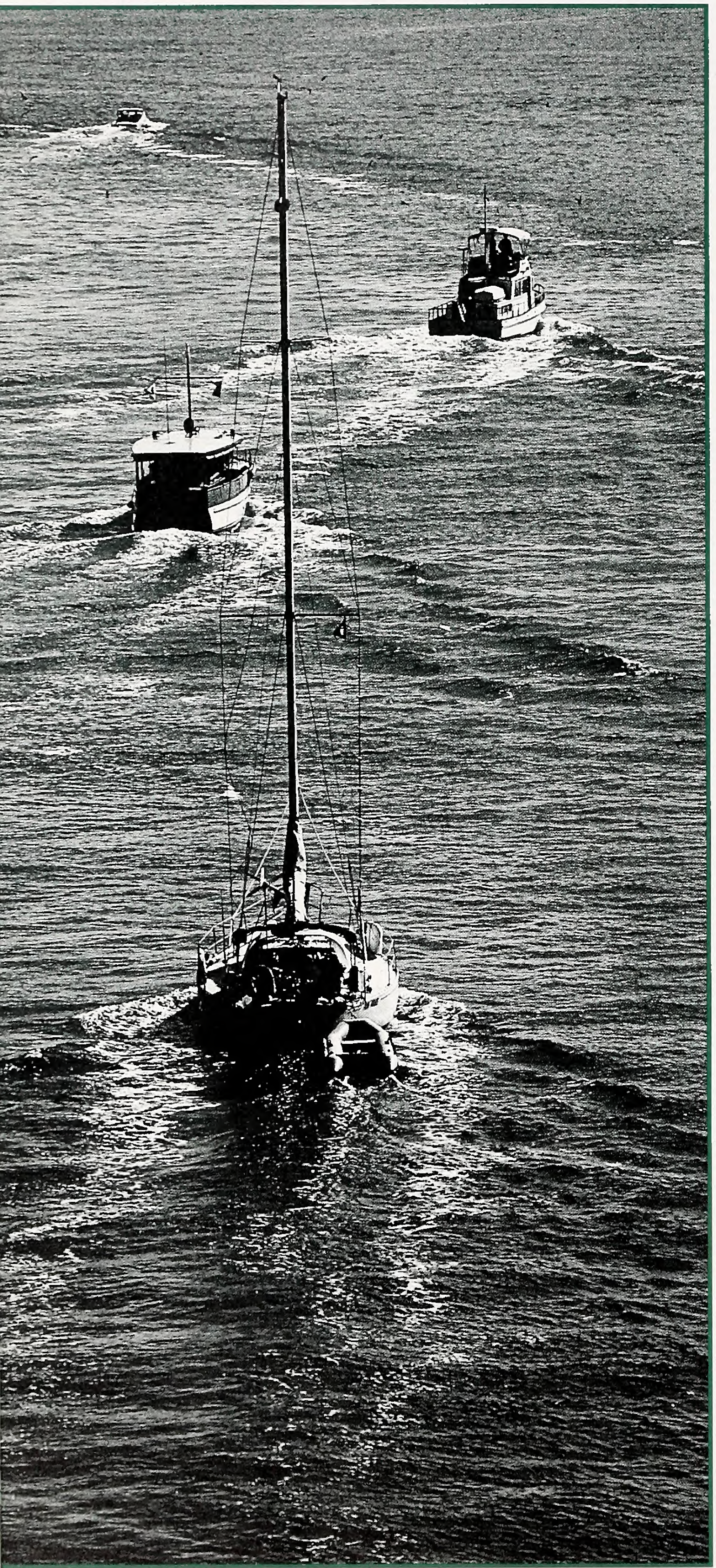


Beaufort's waterfront — a welcoming destination for boaters



Boats cruising the Intracoastal Waterway

"Those people have time to travel and money," Little says. "If they didn't, they wouldn't be cruising the Intracoastal Waterway on a 65-foot boat. So how can we slow them down, extend the time they stay in our state and expand the opportunity to spread their money throughout coastal North Carolina?"

As a start, the council is identifying water trails and linking existing routes, forging separate paths with hubs for three groups: paddlers, motorboaters and cruisers. The water trails are a way to divert traffic off the main highway of the Intracoastal Waterway to explore waters less traveled. The plan is for boaters to be able to use guided maps full of information on destinations and travel times to visit North Carolina's historic, natural and cultural sites.

One five-day route already drawn is the Albemarle cruising trail that passes through Elizabeth City, Hertford, Edenton, Plymouth and Columbia. Another route being considered would revisit a town's past as a 1758 customs center.

"In the future, look to Murfreesboro being a destination for boaters," says Peter Thomson, a council member from Elizabeth City. "Do you know that Murfreesboro used to have some sailing ships to Barbados and Boston? ... So all these towns are rediscovering the water. And all we're trying to do is mark a trail from the main highway to them so that boaters can really discover them."

A self-described film director, businessman and marketing guru, Thomson has cruised worldwide and believes North Carolina's treasures are unparalleled.

"Somebody who comes here with a touring boat is just astonished at what North Carolina has in terms of touring waters because it is unique really within the world," he says. "What we really have is a lot of small historic towns on waterways that are navigable and much more navigable than anybody knows ... unspoiled, unindustrialized, stop your boat where you want, swim when you want, just absolutely gorgeous (waters)."

These possibilities are sure to tempt eco-adventurers. Teeming with wildlife like eagles, herons, ospreys and even a few alligators, the North Carolina coast rivals the Everglades, Thomson says.

"You can stay at a bed-and-breakfast in Plymouth, and you can take a different paddle trip every day for a month in a kayak or a canoe and just not cross the same piece of water," he says. "These are the biggest sounds in North America. ... There's just nothing like it. You go across a 20-mile body of water, and you maybe see two boats."

To lure boaters, the council plans to distribute a brochure on North Carolina boating destinations at major U.S. boat shows, says council member Mike Bradley, director of the Wilmington-based Marine Trade Services program, which provides advice to small businesses. He sees the targets as not merely boaters but also those who enjoy watching the sport from the docks.

"If you ever go to Beaufort and find a way to get into a restaurant along the water, as you wait in line, (you'll see) there are a lot of people who like watching boats," he says. "It's an incredible tourism draw."

Besides touting the state as a boating haven, the council plans to offer more accommodations and recreational opportunities for boaters, he says.

When choosing a destination, boaters look for dock slips or mooring sites close to food, lodging and other services. Fourteen municipalities along North Carolina's sounds and coast could fill these needs, but few do, Bradley says. So most of the boaters traveling the Intracoastal Waterway each year — a figure he estimates at 20,000 — do not stop to visit in the state.

"North Carolina is really unique in that we have 3,000 miles of tidal shoreline, and boats on the coast can play in 2 million acres of water," he says. "Right now, with the exception of New Bern, Beaufort and Elizabeth City, there are not many destination sites for the cruising boat."

Docking is difficult in Washington, for example. The town has a "massive" walkway along its waterfront but few slips, while Bath has policies preventing construction of marina structures, he says. Wilmington is the largest city on North Carolina's coast with the most downtown waterfront and walking access to 40 restaurants, but it has the fewest slips for cruising vessels, he says.

"Wilmington has about the equivalent of three docks with utilities for cruising boats," he says. "What this tourism council wants to do is to educate cities like Wilmington, Bath ... to show the advantages of what the tourism dollar can do both from people who come to watch boats bob and people who come in the boats."

With the passage of the Urban Waterfront Law, the path is paved to build the waterfront accommodations boaters seek. The law permits coastal cities to build non-water-dependent businesses along the waterfront and over the water for the next three years.

"It all fits together," Bradley says. "We're trying to get the municipalities to appreciate how important waterfront activity is to tourism and to make it easier for private industry to build and operate these support, recreational types of businesses: restaurants, inns and marinas. It's big money, big tourism."

If the tide of boaters starts washing in, what may appear new actually will be a return to the old.

"We are, historically, a state of boating," Bradley says. "If you talk to the old-timers in all of these little cities — how did they get to town? They went by boat. How did they get their groceries? They went by boat. They went to school, got married, everything was done by boat."

"And then for 60 to 80 years, we've turned our back on the water. And we've created obstacles to accommodate the boat. And now we recognize that tourism is the number-one industry along the coastal waterways, and it's time to turn our face to the water and see what we can do to accommodate and promote waterway tourism." ◘

Enjoying the Dismal Swamp's natural beauty

Elliott Coues Nature Trail at Fort Macon was named for the 19th-century naturalist.

Elliott Coues

A Naturalist at Fort Macon

By David Cecelski • Photographs by Scott D. Taylor

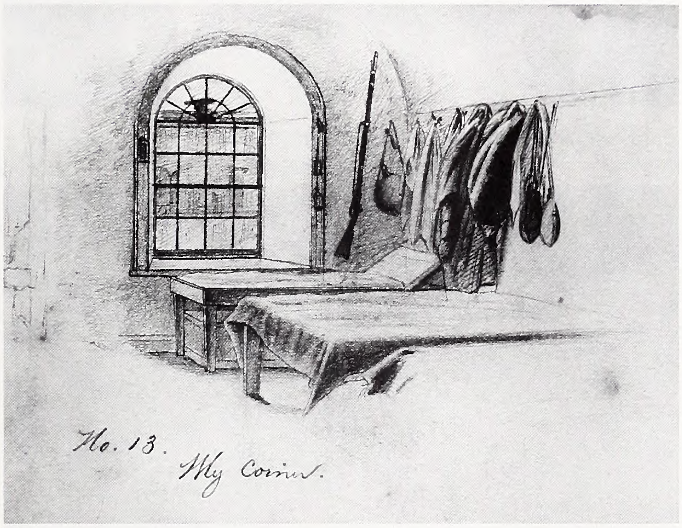
In February 1869, a U.S. Army surgeon named Elliott Coues began a two-year tour of duty at Fort Macon. Destined to become the foremost American ornithologist of his day, the young Coues (pronounced "cows") resented the sandy, remote and wind-swept eastern end of Bogue Banks. He called it "a detestable place" and said he "always felt it a sort of vague disgrace" that the Army had exiled him so far from the Smithsonian Institution, and Boston and Philadelphia, the nation's other capitals for the study of natural history.

Yet Coues made the most of his stint at Fort Macon. Bogue Banks, he had to admit, was "a good place for field natural history." He did exhaustive studies of shorebirds, marsh birds and seabirds, but hardly confined his curiosity to winged creatures. Before he left in November 1870, Coues had conducted the most thorough survey of animal life on the southern coast, most of it published in a five-part series in the *Proceedings of the Academy of Natural Sciences of Philadelphia*.

Born Sept. 9, 1842, in Portsmouth, N.H., Coues was a protégé of Spencer Baird, the Smithsonian Institution's founder. He had hoped to join his mentor in Washington, D.C., after fieldwork in Arizona and South Carolina. But, like many 19th-century naturalists who were not independently wealthy, he found an Army medical career his only real chance to see the world and make a name for himself. He earned his medical degree at Columbia University in 1863 and stayed in the Army for 17 years.

Coues was a prolific writer. While in the Army, he published 300 articles and papers, and he later wrote several landmark texts of natural history. While his far-ranging curiosity led him down some rather eclectic paths — his thousand-page *Monographs of North American Rodentia*, co-written with Joel Asaph Allen in 1877, comes to mind — Coues gained the greatest acclaim for his *Handbook of Field and General Ornithology* (1890) and *Key to North American Birds* (1903), two classics renowned for their accuracy and Coues' beautifully hand-drawn illustrations.

When Coues and his wife moved to North Carolina in 1869, 125 enlisted men lived within Fort Macon. Married soldiers resided in six wooden barracks nearby. Coues wrote in an 1870 report for the surgeon general's office that the fort was overcrowded, moldy, lacking proper sanitary facilities and exposed to "shifting winds" that "wafted malaria from the swamps of the mainland." He called his own living quarters "most wretched" and said they "are all going to pieces; they all leak, and afford but little protection from the weather."


No. 13.
My Corner.

Life was spare at Fort Macon, as illustrated in 1862 by a Union soldier, James Wells Champney.

Courtesy of N.C. Division of Archives and History

Fort Macon could not have been too unhealthy, for there certainly weren't enough sick soldiers to make Coues linger at its hospital. In fact, he commandeered his hospital steward, A.C. Beals, and the two spent endless hours rambling across Bogue Banks. Coues recorded every living thing he saw, from alligators to mud snails, sea urchins to gray foxes. And, armed with a shovel, a seine and a shotgun, he collected thousands of specimens of birds, fish, mammals, reptiles, insects and marine invertebrates.

On arriving at Fort Macon, Coues wrote Baird and asked him to send mustard seed shot, powder and caps for shooting birds and arsenic for preserving them. "If so," Coues wrote, "I will give S.I. (Smithsonian Institution) pretty much everything I collect," which he did. (A shotgun, not binoculars, was the essential tool for a 19th-century ornithologist, and Coues typically shot 50 to 100 of each species unless it was rare.) The *Annual Report of the Smithsonian Institution* in 1869 indicates that Coues donated "two boxes bird skins and osteological collections." He sent other Bogue Banks specimens across the United States, including crustaceans to the Chicago Academy of Sciences and even insects to the Boston Society of Natural History.

Coues was not the first naturalist to attract national attention to the Fort Macon/Beaufort vicinity. To my knowledge, that honor falls to William Stimpson, a Smithsonian naturalist who published his "Trip to Beaufort, N.C." in the *American Journal of Sciences and Arts* in 1860. (Stimpson later lost his natural history collections in the great Chicago fire of 1871.)

But Coues, much more so than Stimpson, drew the scientific community to Fort Macon. His articles, the collections that he shared so widely and his habit of inviting his colleagues to visit him at Fort Macon put the Beaufort area on the map of naturalists across the United States. Other naturalists followed Coues to Carteret County in the 1870s. News of the region's potential for marine research spread until Johns Hopkins University established a summer laboratory in Beaufort in 1880, the first of several marine research centers located there.

Coues wrote extensively at Fort Macon. He described the nesting habits of least terns and Wilson's plovers in *The American Naturalist*, the anatomy of bird wings for a journal published by

Continued

the American Association for the Advancement of Science and the habits of marsh rabbits for a journal published by the Boston Society of Natural History. He probably also did much of his research for a later treatise, called "On the Classification of Water Birds," at Bogue Banks.

Not all of Coues' writing was about natural history. In the surgeon general's 1870 report on U.S. military posts, Coues also made a few observations about local eating habits. Shrimp "are scarcely eaten," Coues wrote, but "the oyster ... is abundant, cheap, and of excellent quality." He observed that yaupon, one of the most common barrier island shrubs, "furnishes a drink often used by the lower classes as a substitute for tea" and that "venison is sometimes as cheap as beef." He himself seems to have tasted dozens of different species of water birds, shorebirds and seabirds, excepting only "the most abundant water fowl, the fishing duck (*Merjus serrator*), (as) hardly eatable."

Coues' greatest accomplishment at Fort Macon was his survey of local animal life. Called "Notes on the Natural History of Fort Macon, N.C., and Vicinity," the survey was published in five parts (the last two co-written with his successor at Fort Macon) in the *Proceedings of the Academy of Natural Sciences of Philadelphia*. It includes an exhaustive listing of reptiles, fish, mammals, marine invertebrates ranging from jellyfish to annelid worms and more than 200 bird species.

Coues' survey is a unique glimpse into what Bogue Banks was like in the 19th century. Only a few families inhabited the 26-mile-long island in 1869-70 so that Coues was describing an environment scarcely touched by commercial fishing, much less industry or tourism. Not surprisingly, his "Natural History" refers to a landscape much different than exists at Bogue Banks today. Many animals he described, such as lynx and mink, have vanished due to hunting and habitat loss. Whaling was still a part of island life, and "the remains of whales," Coues wrote, were "strawn abundantly along the beach."

Elliott Coues Nature Trail takes hikers along scenic views ...

... and encourages them to appreciate a wealth of plant and animal life.

Coues' extraordinary ability to see the smallest details of the natural world also emerges from his "Natural History of Fort Macon." Until I read his description of ordinary fiddler crabs, I never realized how little I had actually looked at them. Coues, an ornithologist, did not know any more about crustaceans than you or I when he arrived at Fort Macon. He had probably never read a scientific paper about them.

But Coues studied his surroundings with a passionate curiosity. He observed the crabs, what bird species ate them, what soils they lived in and how they moved. He noticed how deep, at what angle and what time of day they dug their holes. He even compared the dexterity with which they entered their holes left-side first and right-side first. (He determined "that the animals went in either side first with equal facility.")

I grew up not far from Bogue Banks. Often as a child, and later as an undergraduate at the Duke University Marine Lab, I roamed across its salt marshes just as Coues had a century earlier. I have to confess, though, that I never saw the sea's life as he did. I didn't look closely enough to see the smallest details of a fiddler crab's hole or stay long enough to piece together its place in the island's ecology.

When I visit Fort Macon State Park today, I consequently see its Elliott Coues Nature Trail (just to the right of the fort's main entrance) as more than a memorial to the great ornithologist and his brilliant snapshot of barrier island ecology a century ago: It is a reminder that we all have the ability to discover the marvelous complexity of the natural world — if only we will look. ◘

David Cecelski is a historian at the University of North Carolina-Chapel Hill's Southern Oral History Program.

Electrifying, Exotic and Entertaining –

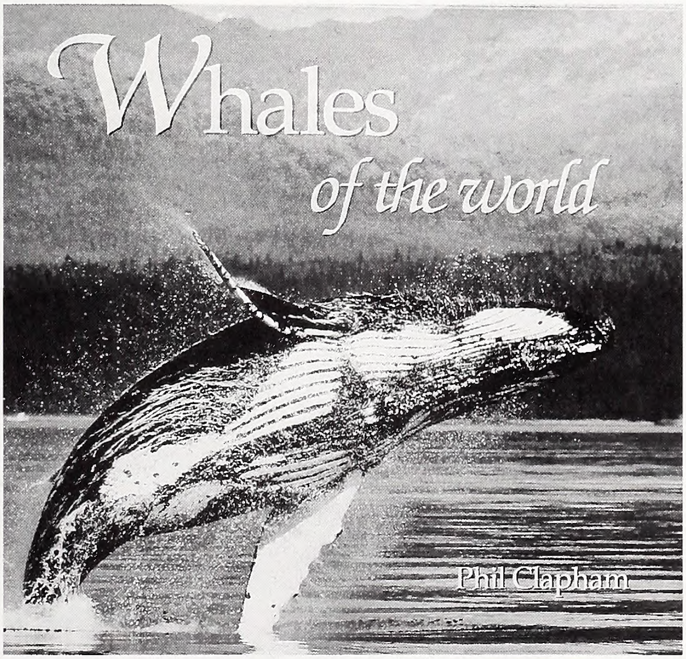
Curl Up With A Few Critters

By Daun Daemon • Photographs by Herman Lankford

The only way most of us will ever see a breaching whale is on a television documentary. Other marine species we'll encounter only in zoos or aquariums. But the seas hold myriad creatures — from bizarre to benign — whose stories can entertain and enlighten us. Studying them up close may be impossible, but meeting them in the pages of a book is satisfying consolation.

• ***Whales of the World***, by Phil Clapham (Voyageur Press, ISBN 0-89658-359-7).

Attractive enough to display on a coffee table, *Whales of the World* is filled with much more than just pretty pictures. Whale expert Clapham, a research associate with the Smithsonian Institution in Washington, D.C., states that his latest book is not meant as a field guide; however, with its clear drawings, close-up underwater photographs and detailed information on numerous species, it could help whale watchers identify the animals they spot. His intent is to give readers an overview of the great whales and their natural history by devoting pages to blue, fin, sei, Bryde's, Minke, humpback, northern right, southern right, bowhead, gray and sperm whales. He also includes the killer whale, which is a large dolphin and not a whale, because so many people readily recognize the species.



In other sections of the book, Clapham delves into the animals' evolutionary background, social behaviors, migrations (some whales travel as far as 5,000 miles on their routes), physiology, intelligence and more. His discussion of whaling is brief but reaches back in time to the Persians of 4,000 years ago and brings the topic to the present by raising modern concerns. Though his sympathetic views about the whales' plight are clear, Clapham avoids becoming sentimental when addressing serious issues about whaling and whale conservation.

• ***The Science Times Book of Fish***, edited by Nicholas Wade (The Lyons Press, ISBN 1-55821-604-9).

Ever wonder how guppies attract mates? Or how coral colonies go to war with each other? Or why fish, as well as their populations, seem to get smaller and smaller? *The Science Times Book of Fish* can answer those questions. The volume is a collection of 44 articles gleaned from 20 years of science columns in *The New York Times*. All are written by science journalists who know how to translate complicated

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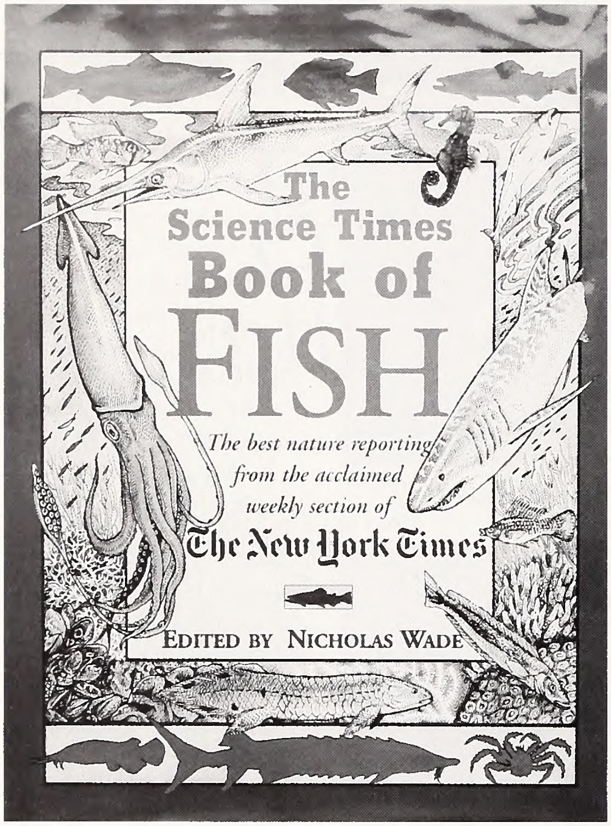

The Science Times Book of FISH
The best nature reporting from the acclaimed weekly section of
The New York Times
Edited by Nicholas Wade

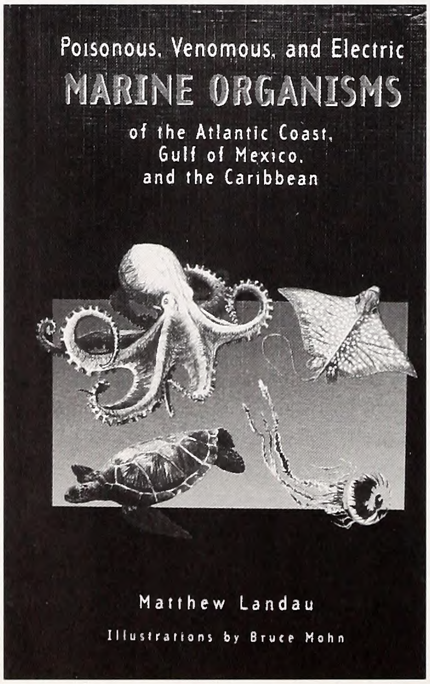
research into fascinating reading.

The articles, most of which are four or five pages long, are arranged into six categories: fish evolution, freshwater fish, threats to freshwater fish, marine fish, the ocean's threatened fish, and shellfish and other species. The book offers a balanced mix of natural history, surprising research and environmental concern. Because the articles were originally prepared for a general newspaper audience, the writing style is crisp and the information readily accessible. The drawings that accompany many of the articles are detailed and varied, from realistic representations of particular fish to menacing scenes of underwater threats.

The Science Times Book of Fish will tickle fish fanciers and science buffs alike. It's a good read whether you start at the beginning and go straight through or skip around from one startling fact to another. Did you know that the orange roughy lives to the ripe old age of 150 and becomes sexually mature at 30? Or that some tropical fish eat fruit?

- ***Poisonous, Venomous, and Electric Marine Organisms of the Atlantic Coast, Gulf of Mexico, and the Caribbean,*** by Matthew Landau (Plexus Publishing, Inc., ISBN 0-937548-36-7).

At first glance, the pufferfish seems a benign species with the cute habit of puffing up like a balloon when threatened. But don't eat one without doing your homework. Certain tissues of the pufferfish can cause an ugly death in a matter of hours. The puffer is one of numerous species that can affect humans with their toxins or other weapons, and Landau clearly explains each. He even includes animals that are dangerous but not poisonous, venomous or electric — for example, sharks, lobsters and even seals (apparently their bites can smart). For each toxic species, Landau explains how intoxication occurs and how to treat it. For example, if you get sponge poisoning, you'll need to have handy some vinegar or isopropyl alcohol, and adhesive tape.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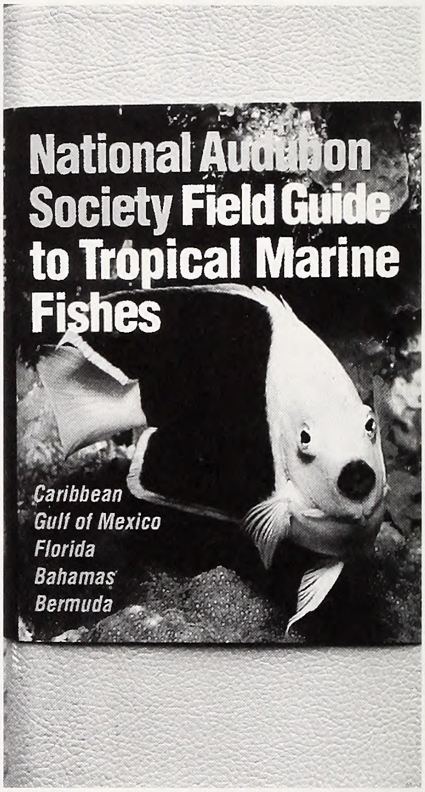
MARINE ORGANISMS
of the Atlantic Coast, Gulf of Mexico, and the Caribbean
Matthew Landau
Illustrations by Bruce Mohn


National Audubon Society Field Guide to Tropical Marine Fishes
Caribbean
Gulf of Mexico
Florida
Bahamas
Bermuda

While the text is clear and direct, many of the drawings are too dark and heavy to be helpful. Some are more impressionistic than realistic. But the book has many other features that could prove useful to fishers, scuba divers and others who spend time in waters inhabited by these species: a list of items to include in a first aid kit, suggested readings and a glossary.

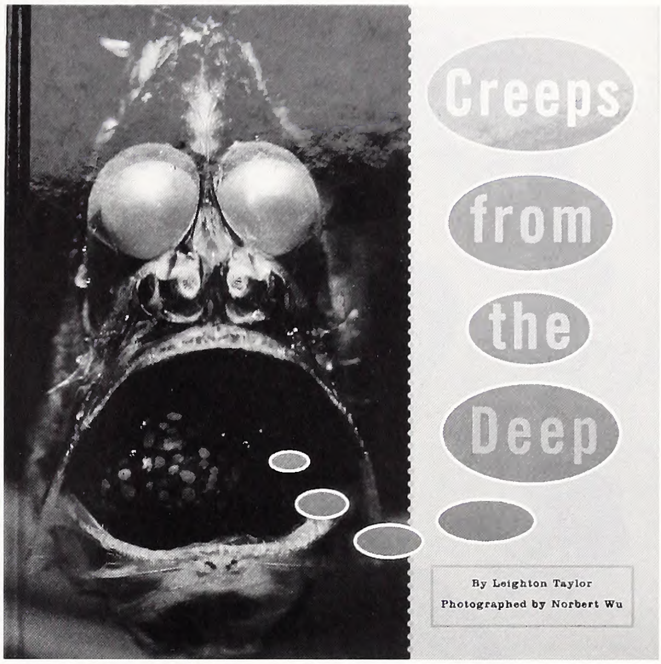
- ***National Audubon Society Field Guide to Tropical Marine Fishes of the Caribbean, Gulf of Mexico, Florida, Bahamas, and Bermuda***, by C. Lavett Smith (Alfred A. Knopf, Inc., ISBN 0-679-44601-X).

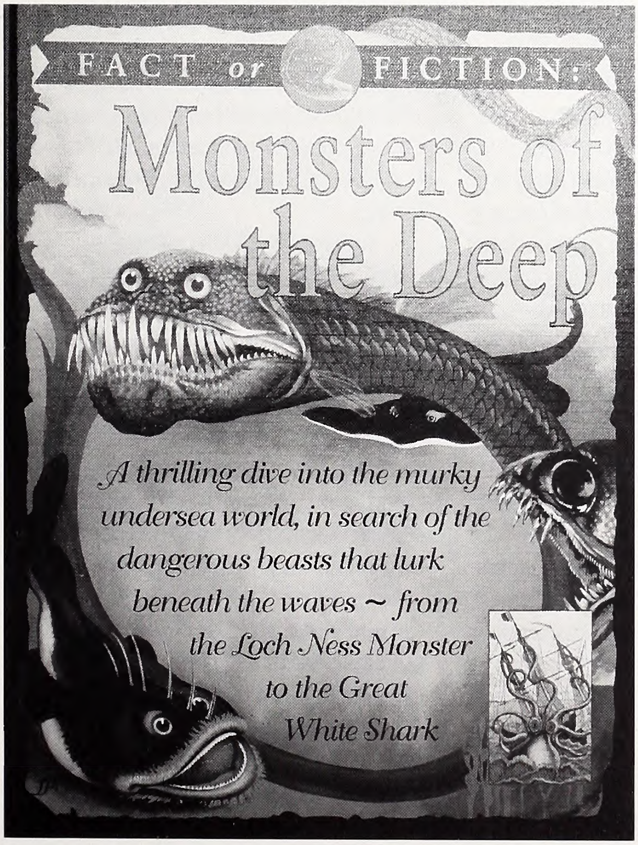
Think you'll ever meet a stoplight parrotfish supermale face to face? If you're sure that you'll confuse him with a redtail parrotfish supermale while scuba diving in the Bahamas, take heart. This Audubon Society field guide will leave no doubt about the differences between the two species. As with the other guides in the series, this one is detailed, easy to navigate and jammed with gorgeous photographs and crisp drawings. Some of the species covered, such as hogfish and crevalle jack, range as far north as North Carolina's coast. This comprehensive guide includes a glossary, a discussion of fish biology and information about habitats.

CREEPY BOOKS FOR KIDS:

- ***Monsters of the Deep***, by Stewart Ross (Copper Beech Books, ISBN 0-7613-0548-3).

More than a book about sea monsters, *Monsters of the Deep* introduces kids to narwhals, icebergs, whales, piranha, tsunamis and much more. Each page is a collage of colorful drawings, photographs and tidbits of interesting information, such as myths from around the world about sea monsters and sea gods. The book's approach is to illustrate fictions perpetuated by myths, fables, literature and films and then give kids the realities. As a bonus, young readers will learn some memorable facts; for example, more people die each year from bee stings than shark bites. Though the text only highlights each subject in a paragraph or two, the book will likely encourage curious kids to search the library or surf the Internet to discover more about subjects from human history to ichthyology, literature to natural phenomena.




FACT or FICTION:
Monsters of the Deep
A thrilling dive into the murky undersea world, in search of the dangerous beasts that lurk beneath the waves ~ from the Loch Ness Monster to the Great White Shark

- ***Creeps From the Deep***, by Leighton Taylor (Chronicle Books, ISBN 0-8118-1297-9).

The befanged viperfish has a face only an alien could love. The tubular-eyed hatchetfish has — jeepers, creepers! — peepers that can look in many directions. These bizarre fish are just two of the creepy deep-sea-dwelling critters highlighted in Taylor's book. With large, clear photographs by underwater master Norbert Wu, this book could spawn a few nightmares in younger kids. But it will surely delight school-aged children with its anecdotes of life at 30,000 feet below the surface. Concise yet comprehensive in scope, the book touches on topics from bioluminescence to submersibles to living in deep-sea pressure. The text is written intelligently and does not sensationalize or trivialize the subjects. Even parents will want to sneak some time for themselves with the book. ◘

Seafood Can Be Kid Food

By Kathy Hart

Children love to watch fish in an aquarium or dangle one at the end of a rod, but all too often, that's the only contact they have with the fisher's catch. Youngsters are frequently reluctant consumers of fish and shellfish, usually because parents fail to introduce them early on to this low-fat source of protein.

But for the sake of their offspring's future health, parents should say yes to fish and shellfish, making it a regular entrée on the dinner menu. Most health organizations suggest two to four servings each week.

Seafood is low in calories; high in protein; low in total fat, saturated fat and cholesterol; high in polyunsaturated fats and omega-3 fatty acids; low in sodium and a good source of vitamins and minerals. It's as rich in calcium as milk and as good a source of protein as red meat. Seafood offers its consumers rare sources of iodine, magnesium and copper. And the omega-3 fatty acids found in fish and shellfish provide a list of benefits ranging from a healthier heart to a reduced risk of certain cancers to proper brain development in infants.

Nutritionists suggest that seafood — particularly mild-flavored fish such as flounder, grouper, tilapia, hybrid striped bass and farm-raised catfish — makes an ideal initial source of protein for toddlers. Using a fork, parents can quickly turn baked, broiled, grilled or poached fish into a finger food that youngsters just beginning to feed themselves can handle alone. It's easily chewed (or gummed) without risk of choking, and it's more digestible than red meat. The mild flavor of many fish species also makes them more acceptable to children's developing palates than stronger-tasting red meat.

When buying fish for toddlers and young children, be sure to choose boneless, skinless fillets or have your seafood retailer debone your catch. Often young children are afraid of the bones, which can get caught in their throats.

If offering children shrimp, remove the shells first. For small tykes, cut shrimp in tiny pieces. If you want to offer your child the whole thing, be sure he has a good set of molars for chewing to reduce the chances of choking.

To interest older children in eating the ocean's bounty, involve them in cooking the catch. At the supermarket or seafood retailer, let them select the type of seafood they would like to sample. Then put them to work in the kitchen peeling shrimp, picking through crabmeat for bits of shell or cutting fish into chunks for chowders or soups.

If you allow youngsters to help prepare their dinner, they're more likely to eat the fruits of their labor. In addition, cooking is a wonderful way to spend time with your children and introduce them to math concepts such as measurement, time and fractions. And learning to cook is another way that parents can boost a child's self-confidence and self-reliance later in life.

Following are three easy seafood recipes that you can cook alone or with your child's assistance.

Tuna Melt Muffins

- 1 can (6 1/2 oz.) water-packed tuna*
- 1/4 cup reduced-calorie mayonnaise
- 1/4 teaspoon Dijon mustard
- 1/4 cup finely chopped celery
- 2 tablespoons dill pickle cubes
- 1/4 cup grated cheddar or mozzarella cheese
- 4 English muffins, split and toasted

In a medium bowl, combine tuna, mayonnaise, mustard, celery and pickles. Spoon tuna mixture onto muffin halves and top with cheese. Place on a paper towel on microwave-safe plate. Microwave on high until cheese is melted, about 35 to 45 seconds. Makes four open-faced sandwiches.

** Crabmeat can be substituted for the tuna in this sandwich.*

Flounder in Foil

- 4 skinless flounder fillets
- 3 tablespoons melted margarine
- 1/4 cup lemon juice
- 2 tablespoons chopped parsley (or 2 teaspoons dried dill, basil or oregano)
- freshly ground black pepper
- 1 small onion sliced and separated into rings (optional)

Place each fillet in the center of a 12-inch square of aluminum foil. In a small bowl, mix margarine and lemon juice. Pour a portion of the mixture over each fillet. Sprinkle with chopped parsley (or other herb) and season with pepper. If your children like onion, top flounder with onion rings. Place another 12-inch square of foil over the fish. Make packets by rolling up foil on each side. Place in a 400-degree oven and bake for 15 to 20 minutes, or until fish flakes easily with a fork. Serves 4.

Fisher's Spaghetti

- 1 small onion, chopped
- 1/4 cup chopped green pepper
- 1 clove garlic, minced
- 3 tablespoons olive oil
- 1 can (28 oz.) diced tomatoes, undrained
- 1 can (8 oz.) tomato sauce
- 1 teaspoon basil
- 1 teaspoon marjoram
- 1 teaspoon thyme
- 1 teaspoon oregano
- 2 bay leaves
- 1/4 teaspoon pepper
- 1 teaspoon sugar
- 1 pound shrimp, peeled*
- 8 cups water
- 1 box (16 oz.) spaghetti

In a pot over medium heat, sauté onion, green pepper and garlic in 2 tablespoons olive oil until onion is clear and translucent, about 5 minutes. Add tomatoes, tomato sauce, basil, marjoram, thyme, oregano, bay leaves, pepper and sugar. Simmer for 25 minutes, stirring occasionally.

While sauce simmers, fill a large pot with 8 cups of water. Add 1 tablespoon olive oil. Bring to a boil and add spaghetti. Reduce heat and gently simmer for 8 to 10 minutes, until spaghetti is tender. Drain in a colander.

As spaghetti cooks, add shrimp to sauce. Cook another 3 to 5 minutes, until shrimp turn opaque. (Do not overcook shrimp because they will become tough.) Remove and discard bay leaves. Pour sauce over hot spaghetti. Serves 6.

** 1 pound of mild-flavored skinless, boneless, cubed fish fillets or 1 can of minced clams can be substituted.* ◘

NATURALIST'S
NOTEBOOK

Salt Marsh Citizen:

The Diamondback Terrapin

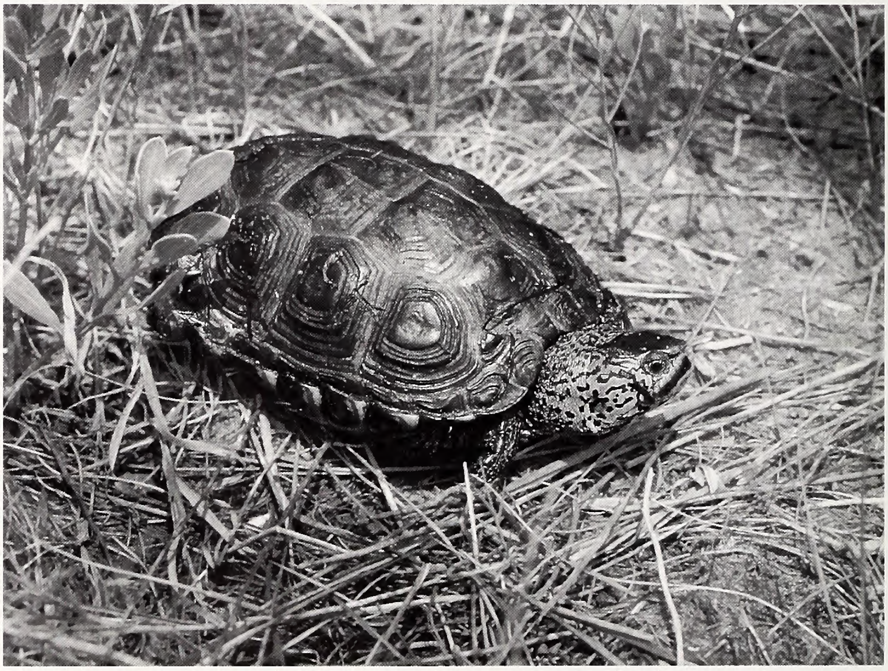
By Lundie Spence

When the first days of spring warm the waters of the salt marsh near Davis, a rather striking turtle claws from her winter hibernation in the mud. Her first intent is to find food. Her powerful forelegs force her bulky carapace through the stalks of *Spartina* cord grass. A hunter, she looks for prey — small creatures inhabiting the water and grasses.

She is a diamondback terrapin (*Malaclemys terrapin*), a resident of the intertidal marsh. Not long ago, the diamondback — locally common along some areas of North Carolina's coast — was itself a hunted creature, and the future of this salt marsh citizen seemed unsure.

Diamondback terrapin populations hit their lowest numbers around the turn of the century, when gourmets considered the reptile a delicacy. The finest restaurants from Baltimore to New York carried terrapin steaks and turtle soup on their menus. Railroad magnate Diamond Jim Brady, notorious for the volume of his meals, is known to have dined one evening on two terrapin steaks, along with three bushels of Lynnhaven oysters, six crabs, two tureens of green turtle soup, seven lobsters, two roasted canvasback ducks, one sirloin, one platter of pâté, 2 pounds of candy and 2 gallons of orange juice.

With appetites like Brady's increasing demand, coastal fishers spent their free time searching for wild diamondbacks, some using trained dogs to find them. Prices were lucrative: Males and small females commanded $10 to $12 per dozen; large 6-inch females averaged $36 to $40 per dozen. According to an article in *The Scientific Monthly* in 1920, one dozen females larger than 8 inches brought as much as $125 wholesale.


Ken Taylor

Malaclemys terrapin

To ensure a supply of diamondbacks, some researchers and fishers raised them on "farms." Scientists at the old Fisheries Laboratory on Pivers Island built concrete pens and winter houses to learn how to breed, raise and feed diamondbacks. The hatchlings thrived when fed small chunks of "trash" fish, small blue crabs and undersized oysters in the winter. And the researchers found that maintaining a brood stock of adult females yielded greater clutch sizes. Enterprising folks in coastal counties copied the Pivers Island model and built their own pens.

But the demand for the diamondback terrapin as food for the epicure peaked in the early 1900s. Many of the finer restaurants closed during Prohibition. In addition, the harvest of wild stock diminished as the populations rapidly declined. The practice of selecting for large, sexually mature females over the years had reduced the breeding population.

Today, the North Carolina Wildlife Resources Commission has given the species a "special concern" designation. Eggs in the nests are broken and young hatchlings are killed by raccoons, foxes, otters, marsh rice rats and seabirds. Adults fall prey to otters and other large predators. Human activity contributes to two causes of mortality: road kills, common where a highway separates sandy nesting sites from tidal creeks, and incidental drownings in gill nets and crab pots.

Gilbert Grant, a Sea Grant researcher with the University of North Carolina at Wilmington, is testing an excluder device for crab pots that will reduce the accidental take of diamondback terrapins. Preliminary studies have shown that crab pots equipped with excluders and located more than 75 feet from the shore may significantly reduce terrapin bycatch mortality. Grant hopes to develop a design that excludes terrapins without reducing the catch of blue crabs.

Perhaps the major reason for the recent diamondback decline is the deterioration and loss of its natural habitat. Possible causes include development and bulkheading marsh shorelines, thus reducing nesting sites; increased sedimentation; nutrient enrichment; boating disturbances; and filling and draining marshes.

To help the diamondback survive these threats, researchers must know as much as possible about its life history. But much remains to be learned about this marsh creature. For example, its feeding behaviors are unclear. North Carolina terrapins eat fiddler crabs, but other populations appear to prefer periwinkle snails. They are also known to eat juvenile blue crabs, mummichogs (marsh minnows) and other fish. Large diamondbacks will even "limb crop" — bite the legs off adult blue crabs.

Phil Spivey, a graduate student at the University of Georgia, has noted that males in the Davis marsh prefer *Melampus* snails, tiny, thin-shelled land snails that hang around high-tide debris, whereas females tend to select larger juvenile blue crabs. While most scientists believe that diamondbacks feed underwater, it is unclear where they capture fiddler crabs, which are intertidal critters.

The terrapins' reproductive behavior is a little more clear. Late spring brings them into courtship, and mating takes place in tidal creeks. Soon after, females search for nesting sites in sandy spots above the high tides. Like loggerhead turtles, diamondback terrapins dig a hole in the sand with their back legs. They deposit six to 12 soft, white, elliptical eggs into the hole, and hatchlings emerge 50 to 70 days later. Females nest throughout the summer in North Carolina, but researchers do not know whether they produce two or three clutches each season.

Once the hatchlings climb through the sand to the surface, their fate presents another mystery. Some reports indicate that the young crawl back into the subtidal mud until the following year and do not feed at all until the next spring. Others indicate that early-hatching young do feed. Alvin Braswell, curator of herpetology at the North Carolina State Museum of Natural Sciences, says their behavior for the first several years of their lives remains a mystery.

To solve one part of the mystery, Spivey is attempting to determine how widely diamondbacks travel. With a spot of epoxy cement, he attaches small transmitters to the backs of terrapins in the Davis marsh and tracks them with radiotelemetry. One female ranged up to a mile, but always returned to a home location. By interpreting these movements, Spivey can one day define the terrapins' home ranges. He has already found that they are more active during the day.

The diamondback's future is as uncertain as some of its habits. In areas with few roads or crab pots and many tidal creeks or old mosquito ditches (narrow channels once used to drain marshes), their numbers have slowly increased. In other places, habitat loss and human population pressures continue to reduce the population. A successful comeback depends on humans maintaining the diamondback's habitat and preventing additional loss of breeding females.

As denizens of intertidal muds and tidal creeks, diamondback terrapins push boldly through the salt marsh grass and bask lazily on sandy banks, unaware of the concern for their survival. Warm weather creatures, they will bury themselves at the first chilly touch of winter. If their marshy homes are preserved, they will continue their cycle and emerge from the mud again, hungry and seeking the sun. ◘

TERRAPIN TIDBITS

- ***Range:*** Gulf Coast of Texas to Cape Cod, Mass.
- ***Size:*** Female carapace reaches up to 9 inches while male carapaces extend no more than 5 inches. Females weigh about 1,200 grams, while males weigh in at 225.
- ***Sexual dimorphism:*** Females are larger, have a rounder head, deeper shell and shorter tail than males.
- ***Markings:*** The carapace varies from a uniform black to light brown, marked by distinct dark concentric rings. The head, upper lip, neck and limbs can have black spots on dark gray, greenish-gray or dark brown skin with margins of orange or yellow. ◘

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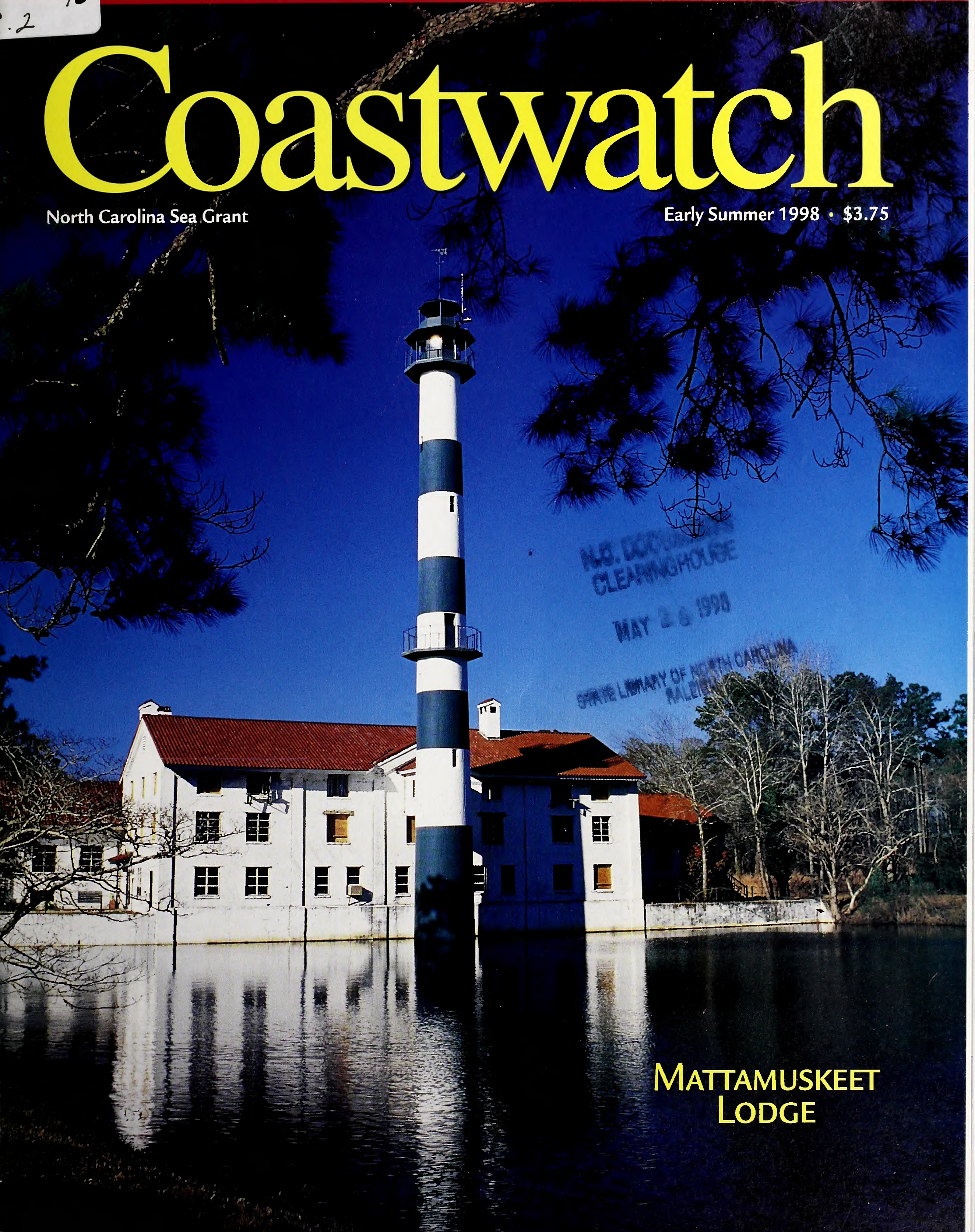

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MATTAMUSKEET LODGE

From the Editors

Claiming the Future

If we're going to make wise choices about the future of our coast, we need the best information possible.

Never has this been truer than now. North Carolina is at a crossroads as it manages the many demands for its coast's rich natural resources — the waters, beaches, creatures and fisheries. It must find a way to balance the economic benefits of a burgeoning population and those resources that attract and sustain the people who come here.

The people who have a stake in these decisions — people who live at the coast, visit occasionally or simply appreciate its beauty — should be part of the process. They should understand the issues, make decisions based on good information and get involved.

One of the best opportunities for fishers to get involved is through the Fishery Resource Grant Program. The legislature created this first-of-a-kind program to pay for qualified citizen research into ways to improve fish stocks and habitat. It lets average people contribute to the health of the resource and gives them a stake in the outcome.

In this issue, you'll read about new seafood technology developed through this program, which is administered by North Carolina Sea Grant. The project — one of 34 funded in 1997 — discovered a way to bind small scallops into thick, chewy medallions without heating or freezing the meat. As a result, North Carolina seafood processors have a new way to sell scallops that were previously too small to market successfully.

Nineteen new projects were funded this spring, and more money will be available later this summer for another round of proposals.

The Fishery Resource Grant Program has become a model for other states. It offers a positive way for people to contribute to issues they care about. And, perhaps more importantly, it lets people claim their stake in the future of the coast.

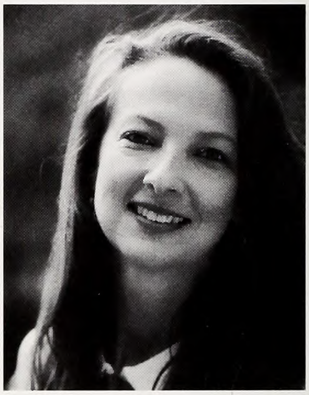
Also in this issue of *Coastwatch*, read how others have staked a claim to their coastal past.

Julie Ann Powers tours the 82-year-old Mattamuskeet Lodge. After sitting empty and decaying for two decades, the lodge is being renovated into a university research field station and environmental education center. Odile Fredericks profiles Karen Willis Amspacher, a proud preserver of Harkers Island's vanishing heritage. Amspacher has galvanized support for a museum in the most unlikely of places — a rugged swamp island. And David Cecelski chronicles the great guano fertilizer boom that built the small coastal town of Navassa. Even the most humble places can have grand histories.

Brooks Preik rounds out the issue with a look at coastal waterfront property. It's some of the most scenic real estate in North Carolina, but the hazards should be considered by anyone thinking about making a purchase. Erosion and storm damage are a fact of life, and the more information people have about these risks, the better able they are to decide what is right for them.

From shoreline erosion to seafood technology, Sea Grant and *Coastwatch* supply the latest and best information to help people make responsible decisions about their coastal resources. ◘

Jeannie Norris



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Coastwatch

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is interim director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for $15 by the North Carolina Sea Grant College Program, Box 8605, North Carolina State University, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: faris@unity.ncsu.edu or ddaemon@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of Mattamuskeet Lodge by Scott D. Taylor

Table of contents photo of blue marlin fishing by Joel Arrington

Printed on recycled paper.

COASTAL *TIDINGS*

North Carolina Nature at Your Fingertips

North Carolina offers a range of natural experiences — from the thick forests of the mountains to the pinelands of the piedmont to the salt marshes along the coast. Amateur naturalists find plenty to study here.

Nature's Ways: Natural History Essays gives readers the chance to make some of those discoveries from their armchairs.

The set's six volumes present essays that appeared in *Wildlife in North Carolina* from 1978 through 1996. Most were written by Lawrence S. Earley, the magazine's associate editor, and illustrated by David Williams.

Arranged chronologically rather than topically, the essays skip among subjects as diverse as judging a tree's age, chimney swifts, hibernation and the function of a tail. Reading straight through is akin to taking a nature walk through North Carolina and stumbling upon discoveries.

NATURE'S WAYS
Natural History essays from Wildlife in North Carolina
North Carolina Wildlife Resources Commission • Division of Conservation Education
I

Herman Lankford

Nature's Ways: Natural History Essays

The index provides helpful information for more directed reading by listing key words for each essay and topics of related essays.

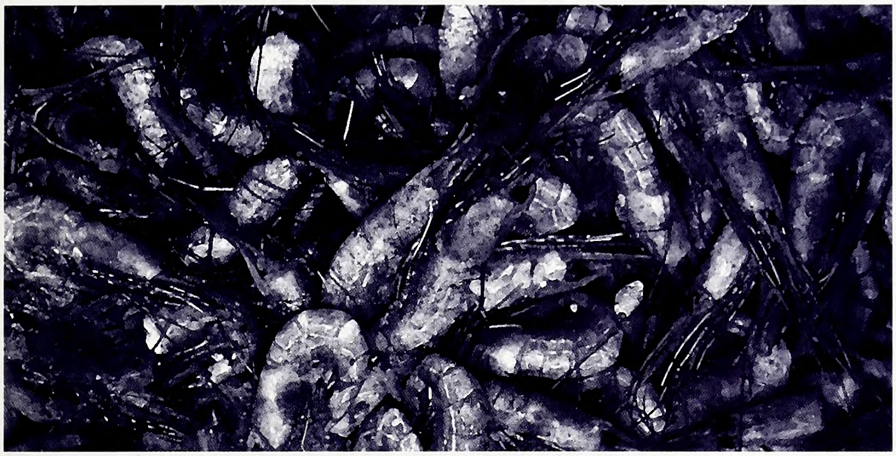
"This collection of North Carolina's natural history profiles can introduce children and adults to the fascinating and complex stories of life around us," says North Carolina Sea Grant's Lundie Spence, a marine education specialist who reviewed articles for the set. "Each feature makes us look closer to see what is in the water, land and air."

All of the essays are accompanied by photographs or detailed illustrations. The large, paperback format allows easy photocopying for students.

To order, send a check payable to N.C. Wildlife Resources Commission for $27.50 (North Carolina residents add 6 percent sales tax) plus $5 for shipping to The N.C. Wild Store, P.O. Box 29607, Raleigh, NC 27626-0607. — D.D.

In the Next Issue of *Coastwatch*

All along the North Carolina coast, our most-recognized landmarks derive from cultural history, natural wonder or sporting heritage. But at the Outer Banks' Oregon Inlet, contention over plans to build massive jetties has come to define a place whose wild shores have few parallels. In the second installment of his series about coastal landmarks, Eddie Nickens visits Oregon Inlet to find context in the controversy.



AROUND THE SEA GRANT NETWORK:

Estuaries, Ocean Currents Crucial to Successful Shrimp Fishery

Georgia Sea Grant researchers Jack Blanton and Peter Verity are trying to determine what oceanographic conditions favor the transport of white shrimp larvae from the ocean to their estuarine nursery grounds.

Estuarine environments, like salt marshes, are crucial habitat for many commercially important species of fish and shellfish. Blanton and Verity have been studying white shrimp — also one of North Carolina's most valuable fishery resources — in the tidal inlets and estuaries of Georgia and South Carolina.

The number of shrimp larvae that reach the salt marsh nursery grounds determines to a large extent the quantity that mature into adult shrimp. The researchers are finding that only certain wind conditions generate the optimum ocean currents needed to efficiently carry larvae from the ocean into the inlet. Their computer simulations indicate that larvae enter the inlets from long and narrow zones that are less than 2 miles wide but that can extend for nearly 20 miles along the coast.

This finding, the researchers say, suggests that jetties and other man-made structures may block larvae from entering the inlet and potentially hamper the recruitment of shrimp into the adult fishery. Blanton and Verity hope that a better understanding of the oceanographic conditions that favor the movement of larvae into estuaries will help resource managers predict the potential for successful commercial and recreational harvests.

Marine Education Bibliography

Teachers, nature guides and parents will find scores of publications to help them educate young people – and themselves – about our planet's watery environments in the fifth edition of *Marine Education: A Bibliography of Educational Materials Available from the Nation's Sea Grant College Programs.* The booklet lists educational publications produced by the 29 Sea Grant programs and research institutions. Included are books, brochures, educational guides, videos, magazines, activity booklets and more. For a copy, send $2 to North Carolina Sea Grant, NC State University, Box 8605, Raleigh, NC 27695-8605.

A Reader Responds

I received my spring '98 issue of *Coastwatch* today. The first article I read, "The Hook," literally brought a tightness to my throat and tears to my eyes. Having grown up in the little village of Marshallberg, and having always seized any opportunity that presented itself to go to the Cape, I am familiar with each landmark, feature and way of life that Mr. Nickens so faithfully and beautifully described. It was moving to read his descriptions of the place, the people and the heritage that are a part of the very bones and spirit of those of us fortunate enough to call this beloved place home.

Mr. Nickens saw not only with his eyes, but with his heart. I believe he has the soul of a Down-Easter. Thank you, Mr. Nickens, for the beauty of your words and your insight. This is a piece that I treasure and shall keep always.

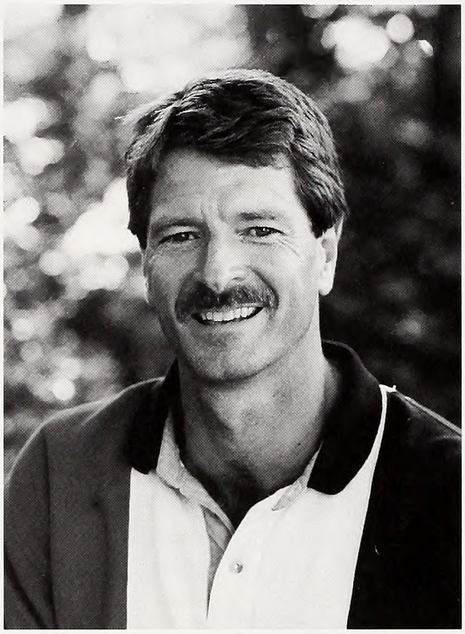
Sincerely,
Carolyn Mason, Beaufort

If you want to comment on an article or issue in Coastwatch, *write North Carolina Sea Grant, Box 8605, NC State University, Raleigh NC 27695-8605.*

Extension Director Takes National Job

After 16 years as North Carolina Sea Grant's extension director, Jim Murray is moving up in Sea Grant. He has joined the National Sea Grant office in Silver Spring, Md., as director of the Sea Grant Extension Program.

In his new position, Murray will be responsible for managing extension program grants and for overseeing Sea Grant communications, education programs, and extension and marine advisory services.



Jim Murray

"We're very happy to have him join Sea Grant's national program office," says Ron Baird, director of the National Sea Grant College Program.

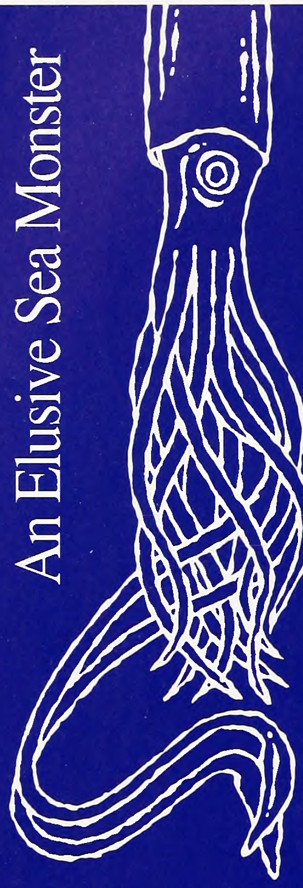
With 22 years in the Sea Grant network — including jobs in Minnesota, New York and New Jersey — Murray is considered one of the best extension directors in the 29 coastal and Great Lakes states. He has made North Carolina a leader in Sea Grant extension programs, especially in research of bycatch reduction devices (BRDs) and turtle excluder devices (TEDs).

"He's good because he can make that connection between what needs to be done to get information out or solve a problem and put that into action," says Ron Hodson, North Carolina Sea Grant's interim director.

The key to his many successes is involving the people affected by a particular policy or rule and persuading them to take a role in developing it, Hodson says.

Throughout his career with Sea Grant's extension program, Murray has been active at both the regional and national levels, serving twice as the national chair of the Assembly of Sea Grant Extension Program Leaders and also as chair of both the Southeast and mid-Atlantic Sea Grant networks. — J.F.N. ◘

An Elusive Sea Monster



The giant squid has populated legends, fiction, horror movies and probably plenty of nightmares. But more than a century after it was featured in the pages of *20,000 Leagues Under the Sea*, the surprising truth is that this creature of the deep never has been observed in its natural habitat.

Scientists do not know how giant squids eat, rest, court, mate, swim or behave. They don't know if they are mid-water dwellers or bottom inhabitants. To learn more about this sea creature, the Smithsonian Institution is mounting a $5 million expedition to observe the giant squid in its natural habitat in the South Pacific near New Zealand. — K.H. ◘

Give *Coastwatch* for Mother's Day, Father's Day

Forget the ties and perfume. Here's a new way to tell your parents how much you love them on Mother's Day (May 10) and Father's Day (June 21). Give them a year at the coast. An annual subscription to *Coastwatch* is $15, and it's a gift that is sure to fit. ◘

A Whale of a Time

During the late spring and early summer, boaters off the North Carolina coast may get a bonus: a whale sighting. Some of the folks who spot the massive mammals call Jim Bahen, a Sea Grant extension agent in Wilmington. They generally want to know two things: what kind of whale they saw and how they can interact with the whales.

"More and more frequently, people are going out on the water to get a closer look," Bahen says. "So I think we need to educate boaters."

Bahen belongs to a team assembled by the National Marine Fisheries Service on the Atlantic coast to help educate the public about marine mammal issues. One of the team's goals is to reduce the number of marine mammals incidentally killed in fishing gear, a problem more common along northern shores. But Bahen says the team hopes to address the problem before it worsens.

Many of the whales passing by North Carolina are humpbacks or northern right whales migrating between their winter homes in the Caribbean, where birthing takes place, and feeding grounds in northern waters. Boaters can cause problems for the animals by approaching too closely or by colliding with them. And it is illegal to harass whales.

The National Oceanic and Atmospheric Administration says boaters should stay at least 100 feet from whales, approach from the side or rear, leave the whales a clear path of movement, limit a close approach to 15 minutes, avoid excessive speed and never throw garbage overboard.

For more information about whales along our coast, call Bahen at 910/256-2083. — D.D.

Rip Tide Warning

This time of year, the summer season of sun and surf stretches ahead, promising plenty of warm days on the beach. But before you step foot into the ocean, it's important to understand the dangers that lurk just a few feet offshore.

A far greater threat than menacing sharks, stingrays or other scary sea creatures is the deadly rip current.

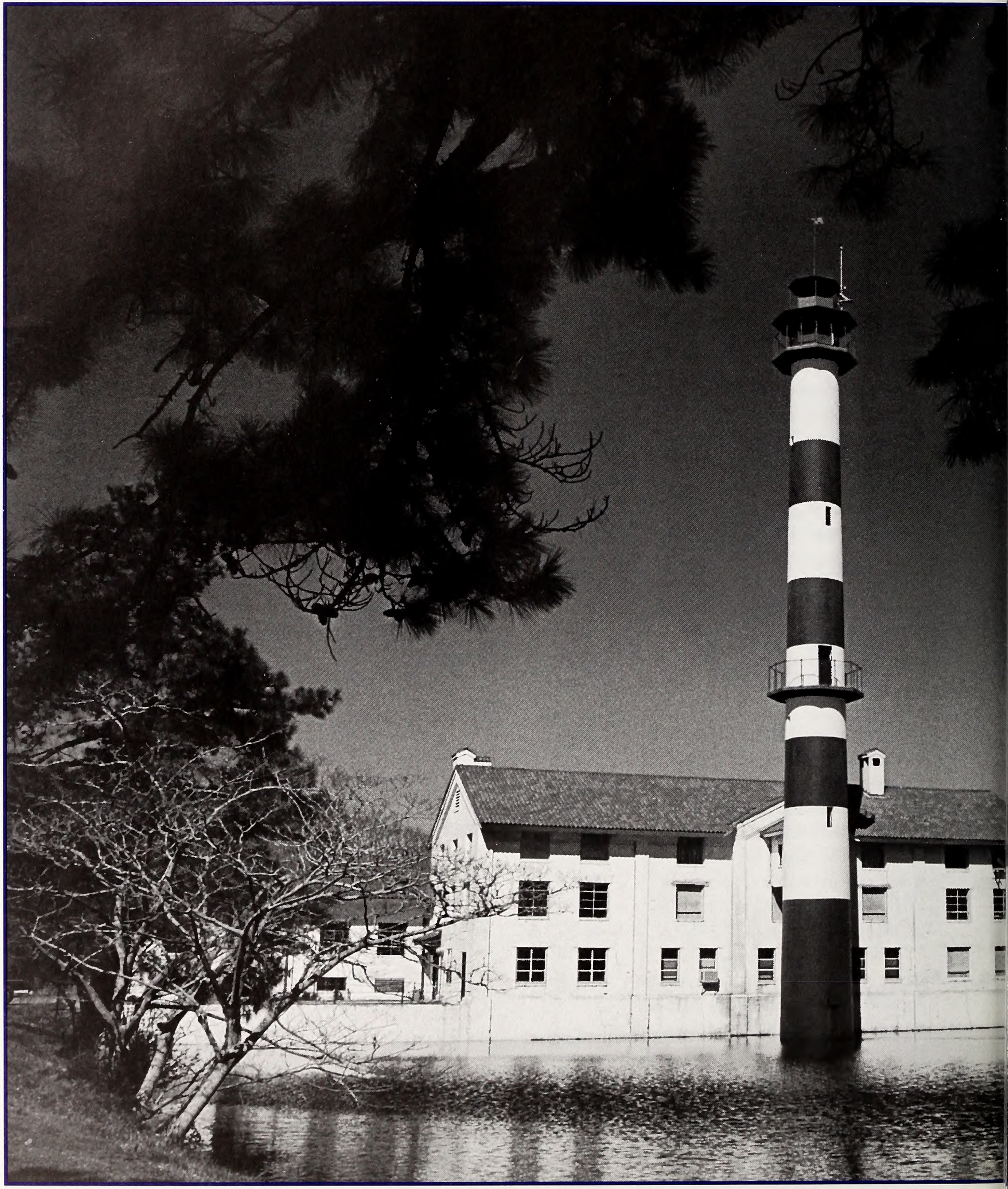
The forces of nature that create swells and waves also produce rip currents off North Carolina's shores. The phenomenon is produced by several forces that come together just a few feet from the beach.

Rip currents begin with the formation of a sandbar that causes waves to break in shallow water. That water is trapped between the sandbar and shore, unable to naturally move back to sea. This water seeks an outlet around the sandbar, creating fast-moving currents away from shore.

Anybody who's been caught in a rip current can tell you the experience is terrifying. But remember to stay calm. The current will dissipate in 50 to 75 yards, where you can escape by swimming parallel to shore and then back in. Do not hesitate to wave for help.

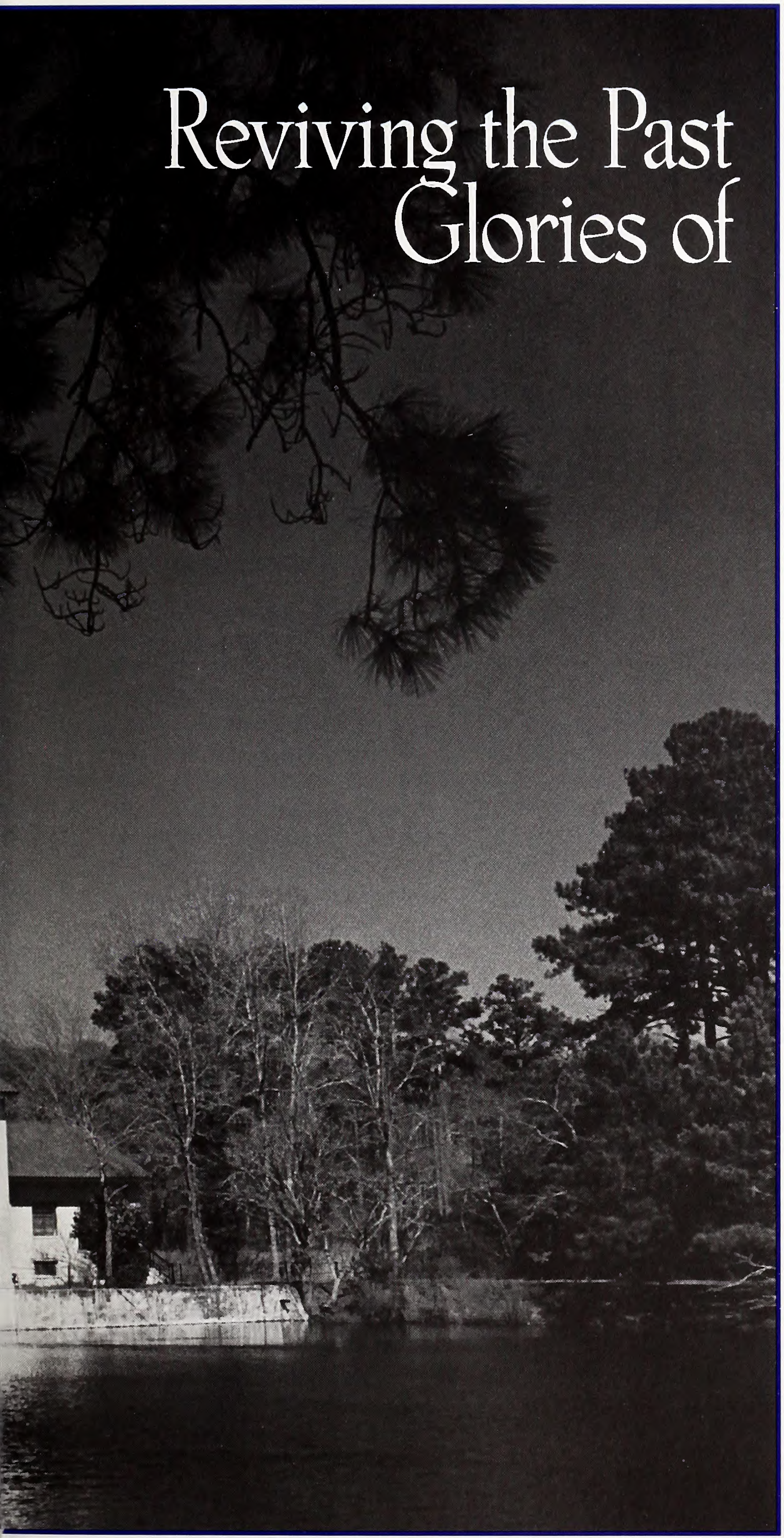
You can take precautions to prevent being swept away by a rip current. Ask a nearby lifeguard if conditions are safe for swimming. And watch for the signs of rip currents: a sandbar where waves are breaking in shallow water, and discolored water and foam moving through the breakers away from shore.

Sea Grant has a free poster and $6 video to help you understand the dangers of rip currents. Call 919/515-9101 or write North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. – J.F.N.



Tucked away in a lush landscape, historic Mattamuskeet Lodge beckons to visitors who appreciate the area's wildness.

Reviving the Past Glories of Mattamuskeet Lodge



By Julie Ann Powers

Photographs by Scott D. Taylor

Its first mission, as a pump house, was to vanquish Lake Mattamuskeet. Its second, as a waterfowl hunting lodge, was to take from the lake's bounty. Now, the 82-year-old Mattamuskeet Lodge has been cast in a third relationship with its environment: to protect and preserve the biological wonderland around it. And this role has saved the striking structure itself from destruction.

After sitting empty and decaying for two decades, the lodge still has plenty of peeling paint and chipped plaster. Nevertheless, the building is at work as a university research field station and environmental education center. The lodge also has resumed its place as the premier community gathering spot. Its neighbors couldn't be happier to see this eminence of Hyde County history find a future. The lodge, with its red-tiled roof and tall blue-and-white-striped tower, holds a place in the hearts of most local residents. A few remember its pump house days; many more recall when it was open for guests and events.

"There's hardly a person in Hyde County who doesn't remember a wedding reception or a prom here," says Annette Gibbs, a lifelong lakeside resident who danced at her own senior prom in the lodge's great hall. "It was heartbreaking to see it closed. You didn't even want to go past it."

The lodge shut down in 1974 and steadily declined until a cooperative rescue effort brought it new purpose. In addition to environmental research and education facilities, the lodge someday will house U.S. Fish and Wildlife Service offices.

Though a massive makeover has just begun, Gibbs, now the lodge coordinator, conducts tours and oversees the lodge's increasingly busy events calendar.

"I'm in love with my job," she says. "I've lived

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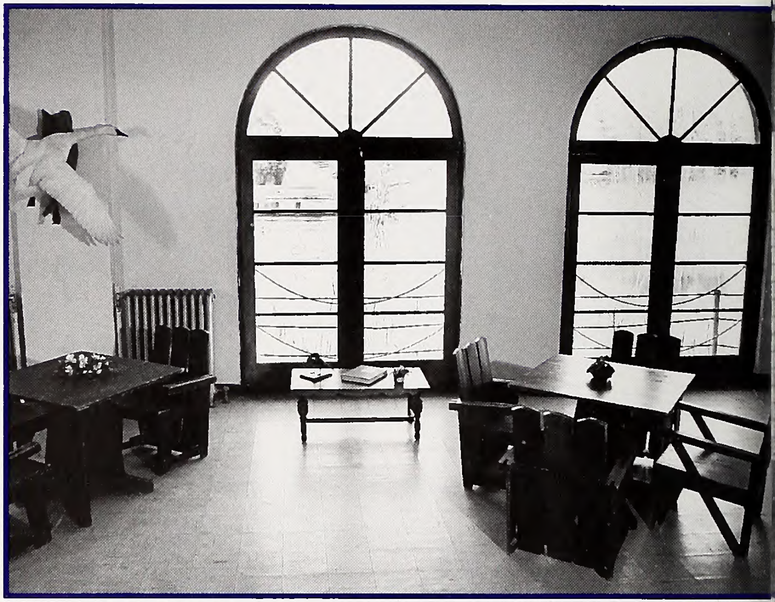
Annette Gibbs manages the lodge's social calendar.



Though spartan, the lodge's interior is spacious and inviting.

here all my life. I'm in love with the lake. I'm in love with the lodge."

Even under duress, Mattamuskeet Lodge is an unforgettable presence. A 12-story observation tower, topped with a flying goose weather vane, resembles a lighthouse, and the white building capped by its red roof, a grand manor. The central three-story section is flanked by smaller wings on either side, and the building is set against a backdrop of lush greenery. The quiet canal waters that form the lodge's front lawn and back yard mirror the tableau.

Inside, the dim corridors and many dusty rooms awaiting refurbishing still seem to emit faint echoes of their past vibrancy.

The work in progress is renovation, Gibbs stresses, not restoration.

"We have two histories, so it's hard to say 'restore,'" she explains. Owned by the U.S. Fish and Wildlife Service as part of Mattamuskeet National Wildlife Refuge, Mattamuskeet Lodge could not feasibly recreate its past personas.

When the building debuted in 1916 as a pump house, it contained gargantuan machinery that succeeded in draining Lake Mattamuskeet. This was no small task, as Mattamuskeet is the largest natural lake in North Carolina. It covers more than 50,000 acres, though its depth averages only 2 feet.

Framed by woodlands and fringed by marshes, the lake's glimmering expanse is a watery magnet for migratory birds and other creatures. In winter, flocks of snow geese and tundra swans turn the water white in places. The swans' low whistles harmonize with the calls of geese and ducks in a winter symphony. Herons, egrets, eagles, peregrine falcons, black bears, otters and white-tailed deer are among the many wild animals that also abide in Mattamuskeet's wild embrace.

Whether enshrouded in morning mist or ablaze with a red and gold sunset, the lake emanates a sense of timelessness and a wisp of mystery. The story of its origin has been lost to the eons that have since passed.

The word "Mattamuskeet" is thought to have roots in an Algonquian word for "dry dust." An Algonquian legend attributes the shallow lake bed formation to a long-burning peat fire. Other theories suggest wind and water created the depression or a meteorite shower pounded it into the soil.

Filled by rainwater and runoff, Mattamuskeet has no natural outlet. Attempts to empty it and farm the rich bottom soil began with the arrival of the first European settlers. Mattamuskeet was twice its current size until the 1830s, when a drainage canal and gravity reduced the lake to its present dimensions.

The canal was commissioned by the predecessor to the state Board of Education. As its financing mechanism for public schools, the board owned the lake, as it did all swamplands. The board and local landowners were planning to pump out the water remaining in the lake's lowest portion when private investors offered to take the project off their hands. The deal was done in 1911. The audacious idea of draining a lake was not original — it had been inspired by a similar, and successful, project in Holland. The North Carolina group adopted the name New Holland Farms for the undertaking.

New Holland Farms built the pump house and 130 miles of canals and, in 1916, switched on the world's largest pumping project. Powered by four coal-fired steam engines, the eight centrifugal pumps could move 1.2 million gallons of water per minute. Canals took the water seven miles south to Pamlico Sound. A model development was envisioned for the newly dry lake bed, with houses and farms fanning out from the pump house.

The first — and, as it turned out, the only — of four planned towns to be created was called New Holland. The town in some ways fulfilled its great expectations. Its 125 residents had running water, electricity and telephones in the early 1920s before the rest of the county. A shipping line on the canals and a railroad through the dry lake bed connected it to the world, while unpaved county roads were often impassable. New Holland had shops, a post office and the New Holland Inn.

But the investors themselves were not

Areas of the building recall its hunting lodge days.

Refuge manager Donald Temple realized the lodge's potential.

faring so well. Problems with the pumps and canals caused the lake to partially refill, and the resulting money troubles forced the first group to sell in 1918. The next owners went bankrupt five years later. The third owners forewent further colonization efforts to concentrate on commercial farming. They cultivated more than 12,000 acres of corn, wheat, flax and soybeans with record-breaking yields.

Then, in 1932, they shut off the pumps, and the water reclaimed the fields and streets. The owners had decided to sell the land to the federal government for a wildlife sanctuary. With the creation of what is now Mattamuskeet National Wildlife Refuge in 1934, a second lustrous era for the building began. The Civilian Conservation Corps — "the army without guns" — arrived, and the employment program's young workers converted the cavernous pump house into guest quarters and dining facilities. They trimmed the 125-foot smokestack to 112 feet and installed a spiral staircase to make an observation tower.

Mattamuskeet Lodge opened in 1937 with 10 rooms. The lodge was an immediate success with goose hunters, and nine more rooms opened in 1941. More than 150,000 Canada geese wintered on Lake Mattamuskeet then. The water was also thick with snow geese, swans and dozens of species of ducks.

The lodge became the center of Hyde County hospitality, the setting for parties and proms. Not all of its guests were hunters. One who later became famous was Rachel Carson, whose 1962 book *Silent Spring* launched the national environmental movement. Carson began her career as a U.S. Fish and Wildlife Service writer. She stayed at the lodge while composing a pamphlet about the refuge and told friends how she enjoyed the "constant, haunting music of the geese."

But the music faded in the 1960s as migratory patterns changed. The Canada goose flock dropped to about 20,000; today the average is about 6,000. The refuge was closed to goose hunting in 1974. The lodge, too, shut down and quickly slid into disrepair. Some say only its 1980 listing on the National Register of Historic Places prevented its demolition.

"When I got here, the building was a disgrace to the agency," says Donald Temple, refuge manager since 1989. "We were getting a lot of criticism."

It wasn't that the wildlife service didn't care about the building, he says. There simply wasn't enough money for both it and necessary wildlife projects. "You had to make some hard decisions," he says. As Temple and others began marshaling action within the service, community commitment, too, was growing. An emotional 1989 reunion brought together former New Holland residents, CCC members and others associated with the lodge, fueling the sentiment to save it. The Friends of Mattamuskeet Lodge Committee formed through the Greater Hyde County Chamber of Commerce and, with the federal wildlife service, sponsored work bees that attracted large and determined crowds of volunteers who pulled down vines, cleared brush, picked up trash, swept away dust, scraped old paint and plaster, painted and performed other cleanup duties. Scientists at East Carolina University in Greenville, drawn by the area's unexplored natural resources, proposed using the lodge as a research station. Political forces became interested.

Before long, ideas to put the lodge back to work as a research center and wildlife service office took shape. Studies deemed the building structurally sound, and with a trickle of state, local and federal money, the immense rehabilitation began. The work got a boost when the Partnership for the Sounds coalesced in 1993. The nonprofit group promotes ecotourism and environmental education as an economic base for the Albemarle-Pamlico peninsula. In an agreement with the federal wildlife service, the partnership set as a priority renovating the lodge for environmental education, field research, wildlife service offices and community functions. The partnership money, from state appropriations, further increased momentum.

Continued

"They have really been the key to getting some things done," refuge manager Temple says.

The partnership also funds the lodge coordinator position. Meanwhile, the wildlife service forged an agreement with ECU on the lodge's east wing. The university's Field Station for Coastal Studies at Mattamuskeet opened in 1996, with 16 beds in six dormitory rooms and modest laboratory facilities. The rooms overlook tree-lined canals and are stocked with some of the sturdy cypress furnishings fashioned by the CCC. The station has since hosted not only ECU students, but scholars from universities as far away as Arizona and from a dozen environmental organizations.

"It's really opened this area up to research and environmental education opportunities," says ECU's Roger Rulifson, the field station director, who invested countless hours of elbow grease in readying the rooms. "It's kind of hard to work out of a hotel room with a microscope."

The lodge offers a window onto a unique, serene world.

From the 1915 Pumphouse Dedication Plaque...
"Mattamuskeet Drainage District. This plant is dedicated to the spirit of co-operation which has here transformed a great lake into dry land, and so created a new and fertile principality for the use, and possession of man."

The agreements specify that the lodge's public areas are available for functions, and its popularity as a social setting is one glory of its past the lodge can revive. Its great hall, with an enormous fireplace and high ceiling, is impressive despite showing its age. Civic leaders hope the concerts, receptions and parties it once again hosts will imprint the lodge on young people, as it did their parents.

"And it'll go on and on," says Steve Bryan, executive director of the county chamber of commerce. Since its rebirth, the lodge has attracted an increasing number of tourists.

"When people find out that that building was built as the world's largest pumping station, they're just in awe," Bryan says. "And they want to go deeper."

Though the lodge is in use, the renovation has just begun. The west wing, which will house offices for three area wildlife refuges, has hardly been touched. So far, the old building has soaked up about $1 million.

"But it doesn't show," says lodge coordinator Gibbs.

The money, from the partnership and local, state and federal sources, has gone into fire escapes, lights, plumbing, heating and other largely hidden necessities. Future improvements should be more visible, albeit slow to appear. They will take at least five years.

"Realistically it will probably be more like 10," Gibbs says.

And it will be expensive. As envisioned, to finish the renovation and complete a museum and nature trails, the work is expected to cost $7 million. Partnership for the Sounds plans a fund-raising campaign later this year, but Hyde County's sparse population regularly registers near the bottom on the state per capita income scale. Still, supporters are hopeful the funds will come forth from the region and beyond for the beloved building.

"I think it's the one thing that unites our county," Gibbs says. "You can have your little differences here and there. But everybody agrees on the lodge. Everybody wants to see it fixed up." ◘

Mattamuskeet Lodge is accessible from U.S. 264 and N.C. 94 in Hyde County. Follow the signs for Mattamuskeet National Wildlife Refuge. Mattamuskeet Lodge is open 9 a.m. to 4 p.m. Tuesday through Saturday and 2 p.m. to 5 p.m. Sunday.

Friends of Mattamuskeet Lodge plans to open a gift shop in the lodge this summer. Renovation of the entrance hall and other construction work will take place during July and August. The lodge will be closed for events but remain open for visitors most days — visitors can call ahead to check. For more information or to schedule tours, call lodge coordinator Annette Gibbs at 252/926-1422.

Lightning's Gift of Fire

By Odile Fredericks

Thousands of years ago, lightning-spawned fires raged regularly along North Carolina's coastal plains, devouring hundreds of square miles. Yet in their wake, bounty followed.

Orchids bloomed. Nature was reborn. Lightning was the bearer of good.

Rather than devastate the landscape, the fires lit from the heavens consumed the underbrush, allowing seeds to germinate. As a result, whole generations of plants adapted to life under fire and came to depend upon it. The patchy nature of the blazes often allowed animals to escape.

"The entire coastal plain portion of North Carolina is one that has evolved through time and been affected by fire, and those fires – at least prior to humans – were ignited by lightning," says Tom Wentworth, a North Carolina State University botany professor. "They were spectacular fires – not in the sense that they were destructive. ... They were light, fast-moving fires that just consumed surface materials and typically did not get up into the crown (of a tree)."

As old as time, lightning seems to have had a predilection for North Carolina, feasting on some inhabitants while giving life to others.

Lightning is more apt to strike the southeastern United States, according to a 1991 study by Texas A&M University. Most of North Carolina received between three and five flashes of cloud-to-ground lightning per square kilometer that year, while a small part of the southeastern corner of the state was struck between five and seven times. Central Florida experienced the most intense concentration nationally, with nine to 13 flashes per square kilometer.

Continued

Lightning Lore

Throughout history, lightning has been important to cultures the world over. For example, to the Cherokee Indians, lightning was a persona to be reckoned with — fuel for their hopes and fears.

They believed that the wood of a tree struck by lightning had mysterious properties, especially if the tree continued to live, and their conjurers used it in secret potions, according to James Mooney's *History, Myths and Sacred Formulas of the Cherokees.* To ensure a good crop, they first soaked their seeds in water containing green bark from lightning-struck trees. But they also thought that tossing lightning-struck wood into a field would cause the crop planted there to wither.

Ordinary Cherokees would not touch such wood, afraid that cracks would appear on their hands and feet. The medicine man, however, would burn it into coal with which ballplayers painted themselves. They thought the paint would have the effect of striking their opponents with the force of a thunderbolt.

According to Cherokee legend, the first fire on Earth was created when gods called the Thunders sent down lightning into the bottom of a hollow sycamore tree. A slew of animals, anxious to claim control over fire, remain branded to this day – the raven's feathers were scorched black, the screech owl's eyes became burnt red and the hoot owl got white rings around its eyes from the ashes.

— *Odile Fredericks*

In 1996, the most recent year for which statistics are available, the Tar Heel state was the third-deadliest in the nation for lightning strikes, behind Texas and top-ranked Florida, says George Lemons, a warning coordination meteorologist with the National Weather Service forecast office in Raleigh.

Some speculate that lightning may have an easier time striking victims in this state of outdoors people. During the prime thunderstorm days of spring and summer, people in North Carolina are on the beach, playing golf, hiking, camping, fishing and tending their gardens, Lemons says.

"When a thunderstorm visits a neighborhood, ... people do not give it the proper respect," he says. "They wait too late to go inside."

Besides, North Carolina has the ideal ingredients for thunderstorms – warm, moist air in the low levels and cool air aloft, says Rod Gonski, a meteorologist with the National Weather Service in Raleigh.

"With the nearby ocean, the Gulf Stream and, further down the road, the Gulf of Mexico giving us a rich supply of warm, moist air on the low levels, the atmosphere is fertile for producing thunderstorms on a regular basis here," he says.

Over thousands of years, these storms ignited fires that raced along the sandhills and pine savannas of the coastal plains, where generations of plants have adapted and thrived upon the charred landscape.

In the wet pocosins, the heat created by fires causes the pond pine to open its cones and drop its seeds. The state tree of North Carolina, the longleaf pine, may well act as a lightning rod, helping start the fires upon which its life depends in the pine savannas, says James Ward, a curator with the N.C. Botanical Garden in Chapel Hill.

"They may be where the lightning strike actually occurs," he says. "They produce these long, evergreen needles that, when they dry out, are filled with resin and are very combustible and are important fuel for the fire."

Ken Taylor

Fires struck by lightning are part of nature's cycle.

Lightning fires clear out the underbrush, allowing the longleaf pine seeds to fall on soil and germinate. The plant itself has adapted to frequent fire by remaining short in its early years with a deep taproot and a tip protected by pine needles. After seven or eight years, it begins to grow rapidly, shooting up 2 to 3 feet a year, and lifts its growing tip above the height of most fires.

Meanwhile, a host of other plants – such as the carnivorous Venus' flytrap, butterworts and sundews – can survive only in a longleaf pine savanna where the underbrush is regularly cleared out by fires.

New growth emerges from the scorched land.

Ken Taylor

Here, many species of lilies and orchids thrive, and the diversity of plant life results from the equalizing force of lightning, which sparks fires that do not allow one plant to dominate another. The longleaf pine savannas may well offer more plant diversity on a small scale than even tropical rain forests, Ward says, noting that scientists have found as many as 50 plant species in just 1 square meter of the savannas.

"The fire puts a damper on any one species being able to take over and dominate a particular piece of land," he says. "It sets it all back. And then, everybody is sort of fighting for existence again, and fire comes along and knocks everybody back. So it's harder for one particular species to gain the upper hand."

Before human settlement, lightning fires naturally occurred on coastal plains sandhills and pine savannas every two to seven years. Without such barriers as roads, they had free reign to cover vast spaces. Nowadays, they have fewer chances of burning as people move into previously uninhabited areas. As a result, plant diversity is expected to keep dropping in fire-prone landscapes.

"Without fire, a few of the plants may really prosper, but many of them will eventually succumb because, in general, they are all adapted to this frequent fire cycle," Ward says. "Even the big plants like longleaf pine are eventually going to suffer because their seeds need to drop in a soil that sunlight hits and that has a high mineral content. And without fires, the ground gets shaded and begins to accumulate humus and has a higher organic mix so that it can't regenerate itself without fire."

Lightning's life-giving forces may appear surprising in view of its reputation as a killer. But scientists have long thought that we may be indebted to lightning for the presence of life on Earth.

Billions of years ago, they theorize, lightning's bombardment of the primordial atmosphere helped turn it into organic molecules, which rained into the oceans. Over time, these molecules became increasingly complex, eventually developing into the earliest forms of life.

Staying Safe in the Storm

Boating and lightning don't mix. If you are caught in a storm, follow a few important rules to help ensure your safety.

- Make sure all of your passengers are out of the water.
- Put away all objects that can attract lightning, such as fishing rods.
- Set course for shore.
- Have passengers lie low and separate from one other in the center of the cabin or boat. Protect and insulate them with cushions. Remove all metal jewelry, eyeglasses and clothing containing metal.
- Do not touch wet objects, metal or electronic equipment such as the radio.
- Do not "bridge" metal objects by having, for example, one hand on a gear lever and the other on a control knob.
- If you are caught out in a small, open boat, lie down as low as possible.
- Learn cardiopulmonary resuscitation (CPR). A lightning strike, or even a near miss, can interrupt a person's heartbeat or affect respiration.

The above tips were taken from Lightning and Boats, *a publication of the Michigan Sea Grant College Program. To order a free copy, write to North Carolina Sea Grant, Box 8605, North Carolina State University, Raleigh, NC 27695-8605. Or call 919/515-9101. Ask for publication UNC-SG-95-05.*

THE PRICE OF PARADISE:

OCEANFRONT LIVING CAN BE HAZARDOUS

By Brooks Preik

An oceanfront home.

For many people, these words conjure up paradise: the sunrise shimmering across calm water, lacy sea oats swaying in greeting to seagulls and sailboats, moist breezes leaving a salty taste in the air. But sometimes the peaceful ocean ripples turn into crashing breakers, the soft air churns into gale-force winds, storms level protective dunes and erosion cuts an ugly swath along the beaches and beneath the foundations of homes.

The land along the coast is in a constant state of change — often a very hazardous one — creating unique problems for residents, developers and the real estate agents who market this property.

At Topsail Island, a barrier island wrecked by Hurricane Fran in 1996, the Association of Realtors has kept a wry sense of humor about its livelihood. Its signs declare "And You Thought We Were All Washed Up" — visible proof that coastal residents' spirit is intact even though their homes and properties were ravaged by back-to-back hurricanes that year.

Yet the constant conflict against the forces of nature requires more than a courageous spirit. Residents wage a battle that has reached monumental proportions

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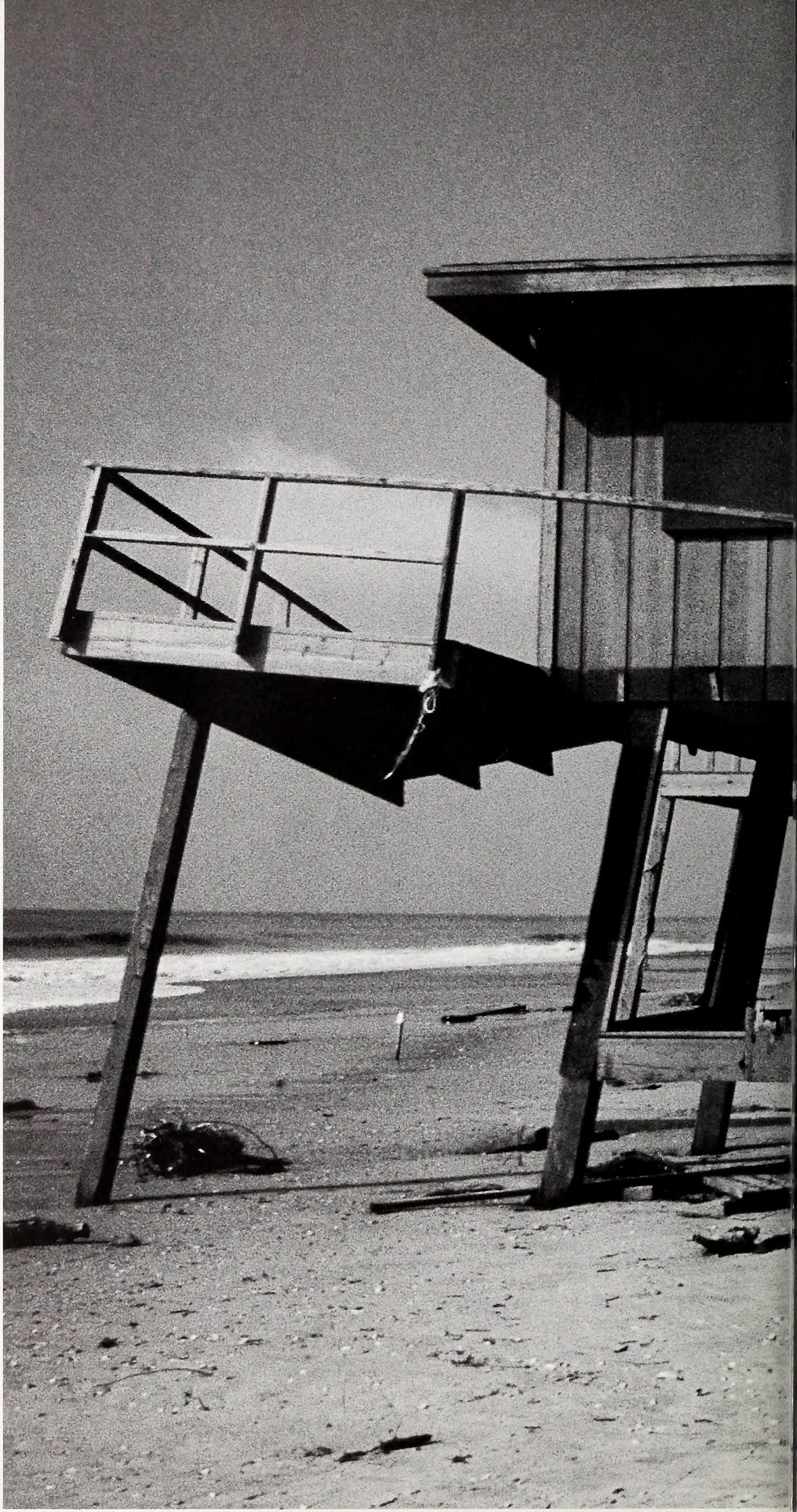
AT RIGHT: EVEN ELEVATED TOPSAIL ISLAND HOMES WERE DAMAGED BY HURRICANE FRAN'S WINDS AND STORM SURGE.



Spencer Rogers

Scott D. Taylor

At Left: Atlantic Beach renourished its strand, but not all communities can afford the process.

due in large measure to the rapid and unprecedented population growth in coastal areas. The battle can never be completely won, but its risks and casualties can be minimized with education and planning.

For years, geologists and engineers have warned of the dangers of buying on the coast, with good reason. Severe hurricanes like Fran, though infrequent, can have devastating effects. And even without the high winds and waves associated with hurricanes, research shows that ocean shorelines change constantly, and many experience long-term patterns of erosion.

New oceanfront property owners need to anticipate these changes and plan for them. Foremost, they should know how to build and where to build or buy. Informed decisions are important because replacing a beach once it's gone is not easy — moving the house is easier. Quick fixes don't exist, and the solutions are expensive.

Beach renourishment is one approach that some coastal communities have used to fight erosion. Dredges and pipelines pump offshore sand onto the beach, where neighbors hope it will stay. But this alternative must be constantly maintained and may pose problems because the supply of offshore sand is smaller than people think.

"Sooner or later there will be serious problems with this," says William J. Cleary, a geologist at the University of North Carolina at Wilmington and a Sea Grant researcher. "Sand is an important commodity and a depleting resource in our area."

Not only is the availability critical, Cleary says, but "it's going to be so incredibly costly." It now costs from $2 to $5 a cubic yard to pump sand onto a North Carolina beach, making it unaffordable for many communities. "In New Jersey, it costs about $30," Cleary says. "And in Japan, sand costs about $250 a cubic meter and has to be imported from Taiwan."

The fix isn't permanent because sand travels. Sand is moved offshore during storms, often with no way of returning to the beach, causing constant erosion and shoreline changes.

Shell Island, at the northern end of Wrightsville Beach, is one high-erosion area that is experiencing costly problems. Shell Island Resort, a high-rise condominium at the tip of the island, has received national media attention in recent months because of the severe erosion caused by Mason's Inlet. Property values have plummeted as anxious homeowners look for solutions, including hardened structures (such as bulkheads) that would halt the encroachment of the inlet. If nothing is done, the structure could be destroyed along with a valuable tax base. If the state allows measures to correct the problem — if indeed it can be corrected — the ramifications may be even more far-reaching. A temporary wall of sandbags is now in place at the tip of Shell Island, but there is a limit on how long they may remain. Should the Shell Island homeowners succeed in their pending lawsuit to strike down the state's ban on hardened structures, the decision could seriously undermine North Carolina's entire system of coastal protection.

Hurricanes and rapid growth create other fears. Joyce Piner, a native of rural Pender County, has lived on Harbor Island near Wrightsville Beach for 33 years. "For many years, we didn't have any major hurricanes," she says. But Piner has a vivid memory of the severe damage that Hurricane Fran caused to her home.

"After Fran, we did give serious consideration to moving but decided to stay. It's where our children have grown up. And it's the way of life here on the island that is important to us," she continues. "With the hurricanes, it's sort of like living on the edge. As we grow older, it's harder to deal with."

It's not just the hurricanes that have changed the Piners' thinking. "There are other things that would influence me to leave now — the increased traffic, the rising cost of living and the fact that the slow-paced way of life is changing," she says.

Because of rising property values, the sale of smaller properties has made way for larger and more expensive homes, changing the makeup of many coastal towns and beaches. And with improved transportation, easy accessibility and more money available to spend on leisure activities, the desire for coastal property is keener than ever. As the migration to the coast continues, it is imperative that these homebuyers — many from out of state — understand the realities of buying beach property so that their investments and the coastal communities themselves are protected.

Real estate agents and developers have an important role in enlightening potential buyers. The stakes are so high that Gov. Jim Hunt recently made clear his position on the matter in a letter to real estate agents and developers. He said both professional groups are responsible for informing buyers of the inherent risks they face in purchasing coastal property.

"We have an obligation to help people who decide to purchase their places at the beach, by giving them as much information as possible about owning property on our coast, including the things they can do to protect themselves — and the things they can't," Hunt wrote.

Robin Smith, assistant attorney general with the N.C. Department of Justice and advisor to the Coastal Resources Commission, explains that coastal real estate is different from that in other areas. "In terms of property law, most of the effects of law on the oceanfront are more magnified," she says.

Coastal property is property that can have a moving boundary line. "With erosion, the property is getting smaller," Smith says. "You lose title to land that becomes submerged, and the state gains title."

When erosion moves the property line landward, the property owner actually loses land. Likewise, new property created by accreted sand belongs to the adjacent landowner.

The Coastal Area Management Act (CAMA) put in place protective rules such as oceanfront setback lines that prohibit building a home or small commercial building within 60 feet of the first line of stable natural vegetation or 30 times the long-term erosion rate — whichever is greater. The erosion rates are calculated by the N.C. Division of Coastal Management and updated every five years.

In areas with long-term or chronic erosion, property owners in years past have tried to save their homes and land by hardening the shoreline with seawalls and revetments. This practice, however, was banned by the Coastal Resources Commission in 1985 because it can cause erosion of neighboring beachfront property and it can interfere with public uses of the beach.

"There is now a lot of scientific data to show that the effects of this are adverse," Smith says.

Similarly, jetties, groins and breakwaters control erosion by trapping sand moving along the shoreline. But in many cases, they solve one erosion problem only to create worse erosion farther down the beach. As a result, these structures can no longer be built on the oceanfront.

With all of these changes in the rules and the landscape, real estate agents find they need to learn more about the regulations North Carolina has imposed to protect both beaches and homeowners. Lois Dixon, a Wilmington broker with 20 years of experience, says she is now more careful than ever to point out possible hazards to buyers.

"I not only gather as much pertinent information as I can about the prospective purchase, but I give the buyers names and phone numbers of agencies and officials

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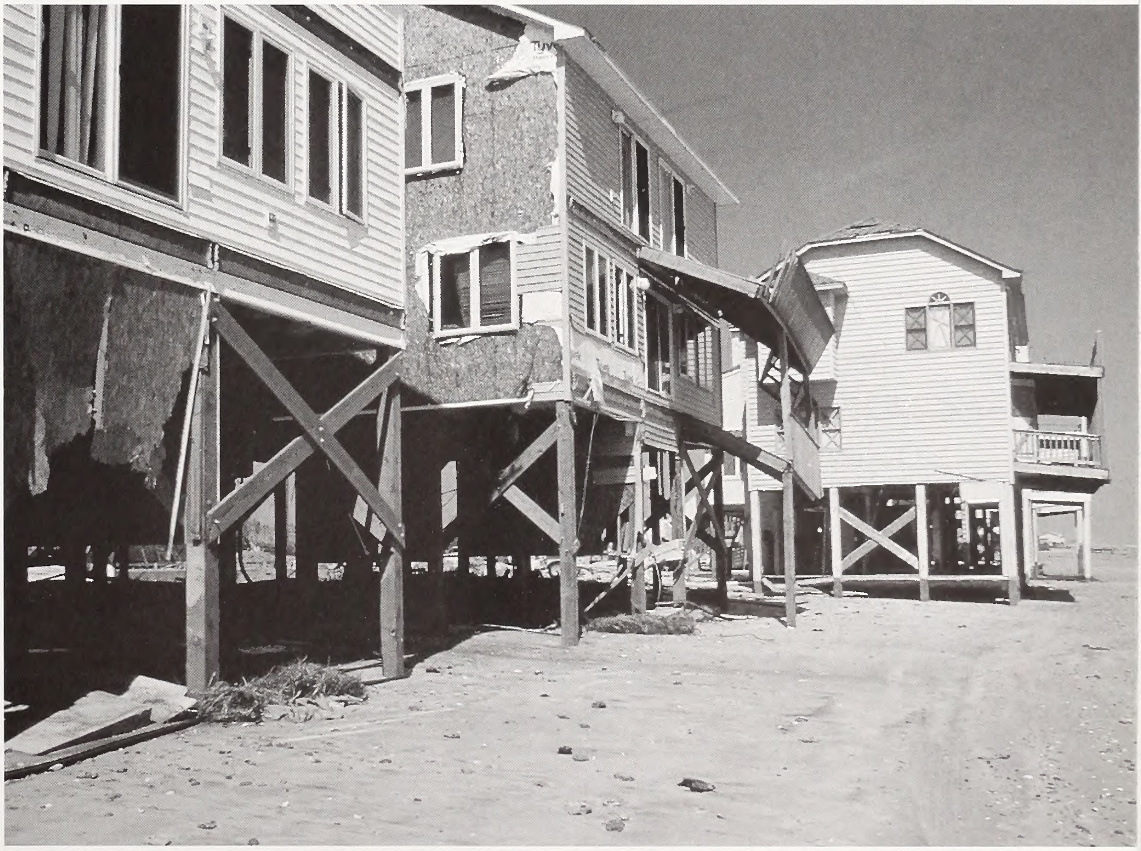


Spencer Rogers

AT RIGHT: TOPSAIL ISLAND HOMES LEFT STANDING SUSTAINED HEAVY DAMAGE IN HURRICANE FRAN.

who can advise them further about the regulations that may affect their investment," Dixon says. "I also insist that they check on insurance prior to making a final decision."

The National Flood Insurance Program (NFIP), created in 1968, provides affordable flood insurance for hazardous areas. This insurance has helped bring economic stability and improved standards of construction to these areas. Opponents of the NFIP argue that people would not build in these locations if this insurance were not available. While flood insurance can be bought at an affordable cost, it covers only damage to the structure from flooding. It does not cover the loss of land from erosion.

Securing adequate homeowners' insurance for wind damage to coastal property has become a critical issue since Hurricane Fran. Not only are insurers refusing to write new policies and canceling old ones, they also are raising premiums and cutting benefits on existing policies.

"There is no law in this state that requires insurance companies to write homeowners' insurance," says Daschiel Propes, chief deputy commissioner of the N.C. Department of Insurance. He adds that his department is concerned about the problem and is working to find a solution for insurers as well as property owners.

The North Carolina Beach Plan, established in the 1960s as a market of last resort for beach areas, is costly and was never intended to be the only source of homeowners' insurance for beach properties.

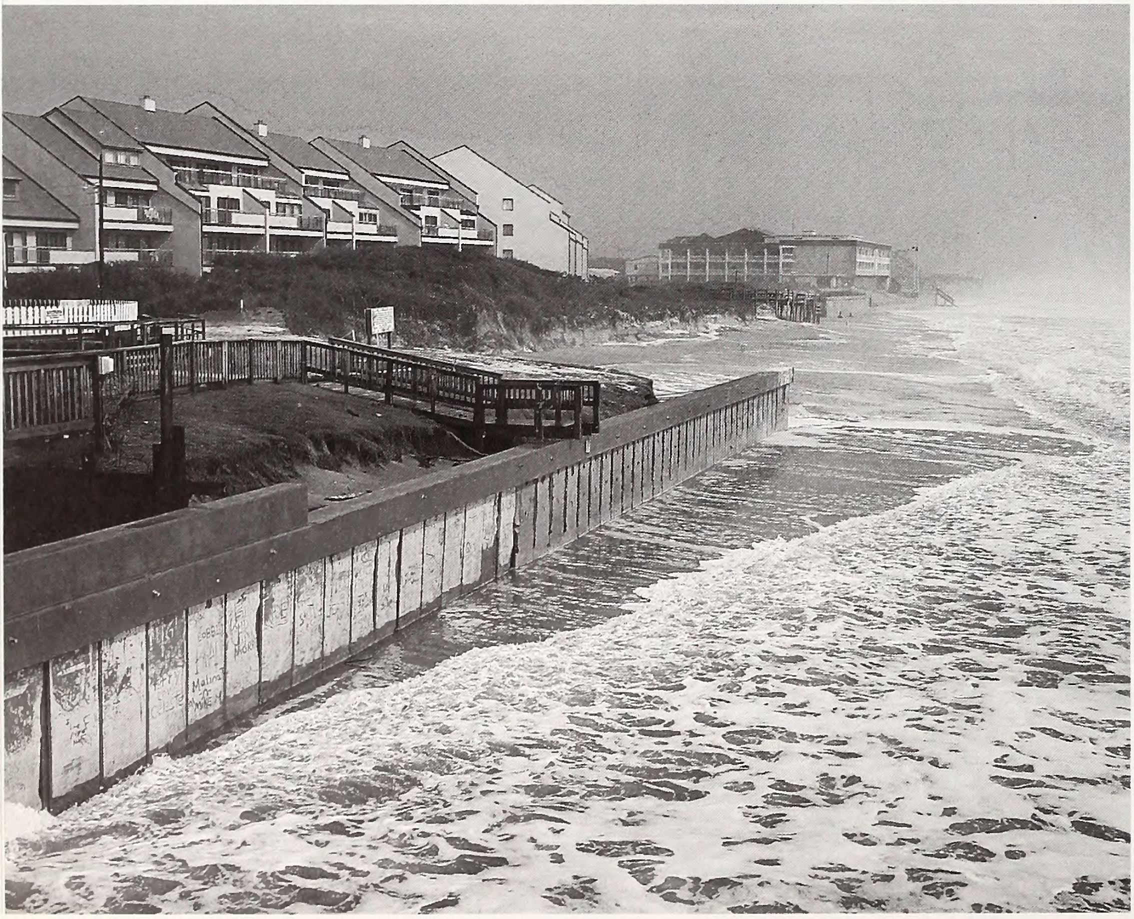
"There is a concern that the inability to obtain affordable homeowners' insurance is a serious threat to the residential real estate market as a result of recent hurricanes," says Bob McKoy, president of the Wilmington Regional Association of Realtors. McKoy met in January with Propes and real estate representatives from 11 other coastal counties to discuss the situation. "This could have a negative impact on our business. There is a need for us to be proactive in trying to prevent that from happening."

And the implications might be felt well beyond the coast. A significant portion of North Carolina's income each year comes from tourism and taxes on property sales. A negative impact on the coastal real estate industry would eventually be felt throughout the state, possibly through a tax increase for all state residents, not just those along the coast.

Meanwhile, experts are trying to find more hurricane-resistant methods of construction in coastal areas.

"One of the best ways to look at what things work along the coast and what things don't is to go in and look at buildings in areas that have been hit by hurricanes," says Spencer Rogers, North Carolina Sea Grant's coastal erosion and construction specialist. "There are usually some very clear-cut reasons why some survive and some fail. First of all, the cardinal rule is never, ever to get hit by a wave."

Rogers isn't joking. The greater damage in a storm is usually sustained from surging water rather than strong winds.



Scott D. Taylor

AT LEFT: BULKHEADS CONTRIBUTE TO EROSION AT PINE KNOLL SHORES.

At Right: Hurricane straps secure construction, but this kind is vulnerable to corrosion on oceanfront homes.

Spencer Rogers

Water and wind destruction from seven major hurricanes that hit the state in the 1950s brought about important changes in the North Carolina building code. "In the 1960s, the building code called for structures that were elevated on pilings at least 8 feet in the ground," Rogers says. "Prior to that, the houses were built on the ground, very susceptible to wave and erosion damage. The code helped change the public perception of a beach house in North Carolina to one on pilings with parking underneath."

This design became popular even in areas where pilings were not required. "Because of that shift in building — far beyond the limited application of regulations — damage in Hurricane Fran was much lower than it would have been earlier," Rogers adds.

The keys to hurricane-resistant construction are measures to resist erosion, flooding waves and wind, Rogers says. The foundation should be deep enough in the ground so that it's not undercut by erosion. It should also be high enough to withstand waves and flooding. The building should be tied together with good connections (nails, bolts, straps) from top to bottom to resist high winds. Good roofing pays off in hurricanes, and window protection (storm shutters) prevents shattering.

Coastal builders are now implementing these measures and more.

At Waterfronte Villas and Yacht Club, a 35-unit condominium complex under construction at Carolina Beach, safety features and aesthetic appeal are of prime importance, says project manager Tom Cunningham. Glass windows and doors used in the buildings are now designed to withstand higher wind speeds. Anchor bolts attaching the building to the footing were increased in size and number, and special attention was paid to the attachment of the roof and the sheathing to the building. The larger, heavier metal clips enable the trusses to support more weight and hold the roof better.

"The rules are more stringent now," Cunningham says.

These rules can give buyers confidence that their new waterfront homes have the latest hurricane-resistant features. And as demand grows for homes with a view of the water, it's important that safety features evolve with the latest research about building to survive storms unique to the coast.

The attraction of the coast remains undiminished by the grim realities of recent hurricanes. But it's important to remember that beach replenishment, building regulations, rising insurance costs and the constant danger of erosion, flooding and storm damage are problems not limited to coastal residents. These concerns and the astronomical costs of federal and state disaster aid are issues that affect everyone. ◘

Brooks Preik is a real estate agent in Wilmington.

In late 1997, nearly 500 real estate agents and developers learned about building, marketing and selling coastal property through a series of workshops sponsored by North Carolina Sea Grant, the N.C. Division of Coastal Management and the N.C. Real Estate Commission.

A free brochure, Questions and Answers on Purchasing Coastal Real Estate in North Carolina, *is available from Sea Grant at 919/515-9101 or the Real Estate Commission at 919/733-9580. The Division of Coastal Management offers* Where to Find Out, *a guide for real estate agents whose clients have questions about coastal property. Call 919/733-2293 for a free copy.*

A HISTORIAN'S
COAST

The Guano Gospel

By David Cecelski

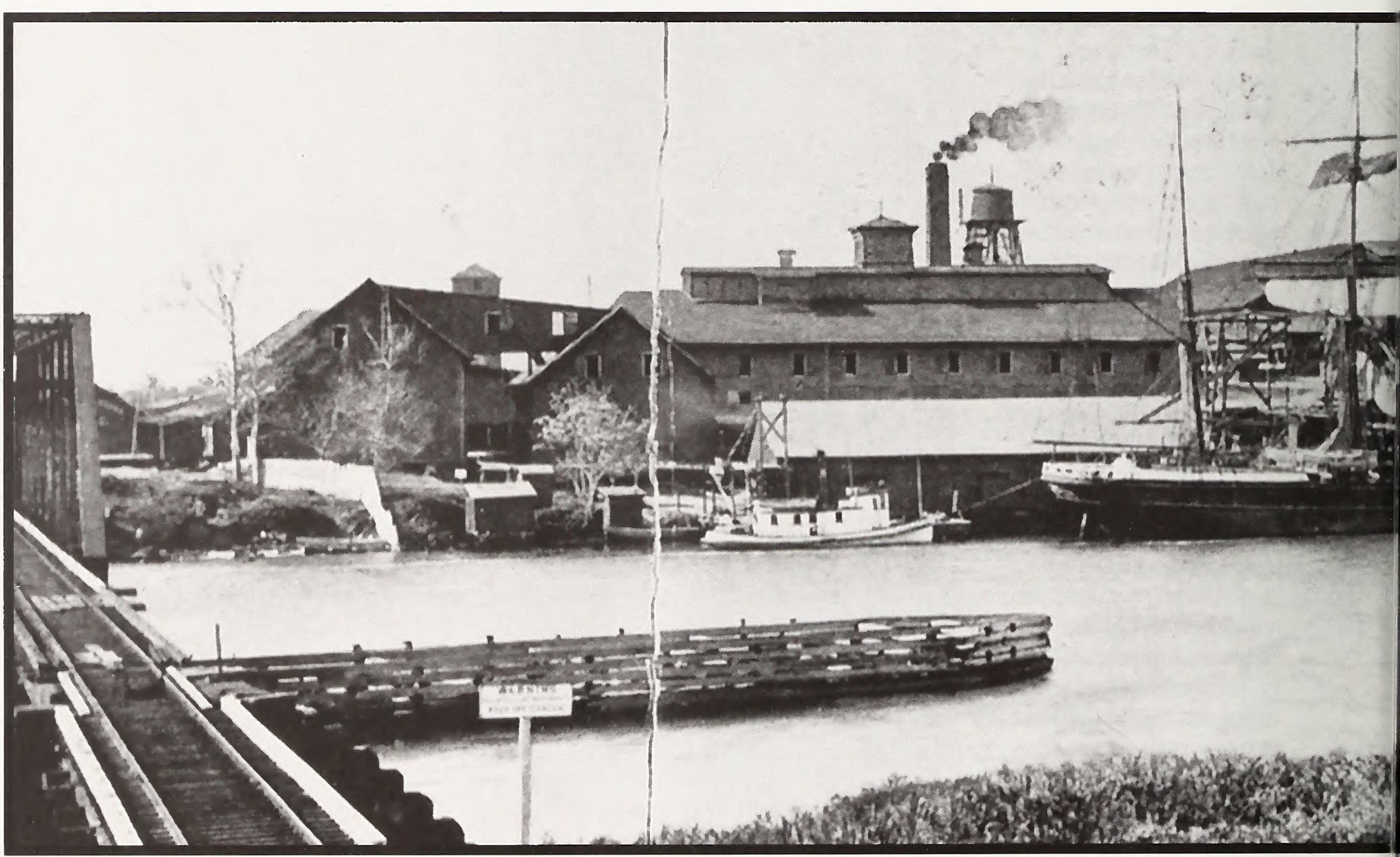


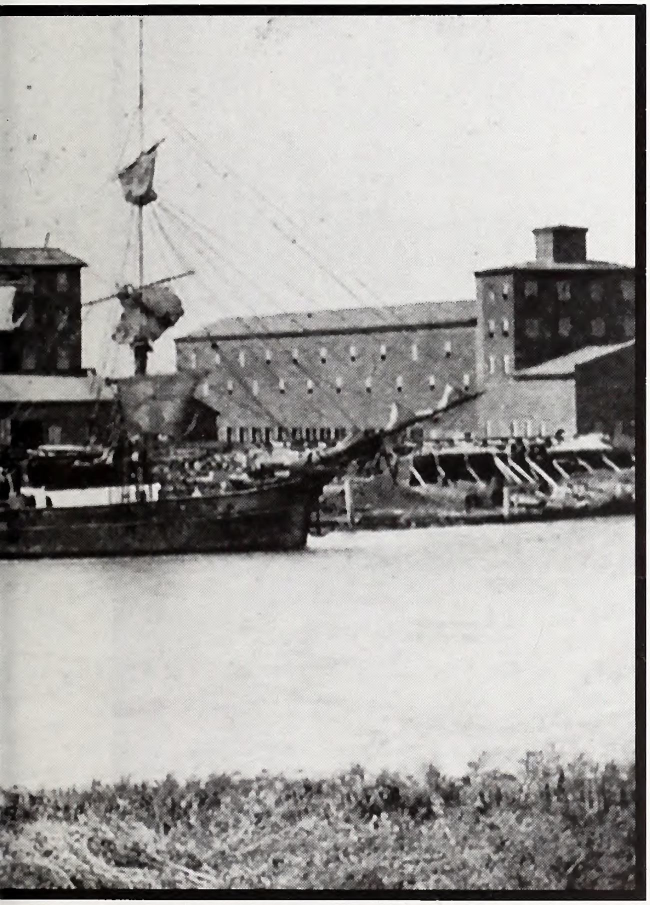
Photo courtesy of the New Hanover County Public Library

Navassa Guano Co., circa 1905, led Wilmington's fertilizer industry.

The smallest places sometimes have the grandest stories. I thought about this recently when I visited Navassa, a small town a few miles from Wilmington. A rural, mainly African-American community, Navassa is surrounded by cypress swamps and river. It's a remote, quiet place without even a small downtown — just country homes with gardens, an old graveyard, a lumberyard, a volunteer fire and rescue squad, a Masonic lodge, the Mount Calvary AME Church and a couple of abandoned fertilizer factories. You wouldn't guess that Navassa's past spans continents and seas — or that it upends much of what we think about our coastal history.

Navassa's story begins with the guano fertilizer boom that swept America in the 19th century. Guano, from the Quechua word *huano*, meaning dung, originally referred only to the dried excrement of seabirds. When the German explorer and scientist Baron von Humboldt visited Peru early in the 1800s, he found some of its rookery islands with 100-foot-thick layers of bird droppings. Countless generations of albatross, gulls, penguins, cormorants and other seabirds had caked the islands with their nitrogen-rich droppings.

First introduced to Europe by Humboldt, Peruvian guano was an extraordinarily rich source of ammonia, phosphate and other nitrogenous compounds, as well as a source of alkaline salts, sulfate of lime and other organic matter that improved plant growth. Demand for guano fertilizer soon



raged across Europe and America.

Peru nationalized its guano deposits around 1840 — running the guano business as a state monopoly — and for the next 40 years earned most of its foreign exchange by selling dried bird feces. During the middle of the 19th century, the "guano gospel" spread like wildfire. The use of commercial fertilizers in general rose especially fast in the American South, where soil exhaustion was high, competition from Western lands was intense and agricultural practices were relatively inefficient. By 1854, U.S. guano imports exceeded 175,000 tons a year, and by 1860, guano represented 43 percent of all commercial fertilizer used in the United States.

To procure cheaper sources of guano, the U.S. Congress passed the Guano Islands Act in 1855. Under this law, American entrepreneurs could claim any uninhabited island in the world if it had the potential for guano mining. Under the terms of the Guano Islands Act, U.S. investors eventually claimed 94 islands, rocks and keys, including a tiny limestone crag between Jamaica and Haiti known as Navassa Island.

The guano at Navassa Island was not mainly bird excrement; it was calcium phosphate and limestone that had been produced by the tectonic uplifting of coral reefs. Though not competitive in quality with Peruvian guanos, Navassa Island's guano — as it was known — was more affordable. This was an especially important consideration after the Civil War, when few Southern farmers could afford the luxury of Peruvian guano.

A group of Wilmington businessmen established the Navassa Guano Co. in 1869. They hoped guano would be a good return cargo for the seagoing vessels that carried lumber and naval stores to the Caribbean. To keep the guano's acrid smell out of Wilmington, they built their factory a couple of miles away on a marshy peninsula at the confluence of the Brunswick and Cape Fear rivers. Originally, the company imported phosphate rock from Navassa Island, which soon grew famous for its abundance of guano and infamous for its working conditions, once deemed "above all known types of punishment." These conditions led to a notorious uprising by guano miners in 1889 in which at least four overseers were killed.

Navassa Island was not mined after 1898, but the Navassa Guano Co. adjusted. Guano, originally only bird droppings, became synonymous with any kind of manure. The Navassa company made fertilizers with nitrate of soda from Peru, potash (wood ash) from Germany, fish from the Atlantic, phosphate rock and cottonseed from other Southern states, and blood and bone from Midwest slaughterhouses. By 1912, the company employed about 300 workers and produced 50,000 to 60,000 tons of fertilizer a year. And the fertilizer industry, led by the Navassa Guano Co., became the most important in Wilmington.

Today, Navassa is an incorporated town of about 600 residents, most of them African-Americans whose ancestors worked in the guano industry. In the company's earliest days "if you worked at the factory, you could live in the former slaves' quarters for free," according to Eulis Willis, a local civic leader who wrote *Navassa: The Town and Its People*. Former slaves from local rice plantations worked at Navassa, and a guano boomtown materialized amid the old rice fields and cypress swamps, with 15 houses, two single men's quarters and two stores at a site known as Bluff Hill.

The town of Navassa grew up around the Navassa Guano Co. "The factory was the lifeblood of this community," Willis recalls. Toward the end of the 19th century, the guano workers began to buy their own land, particularly along a small stream known as

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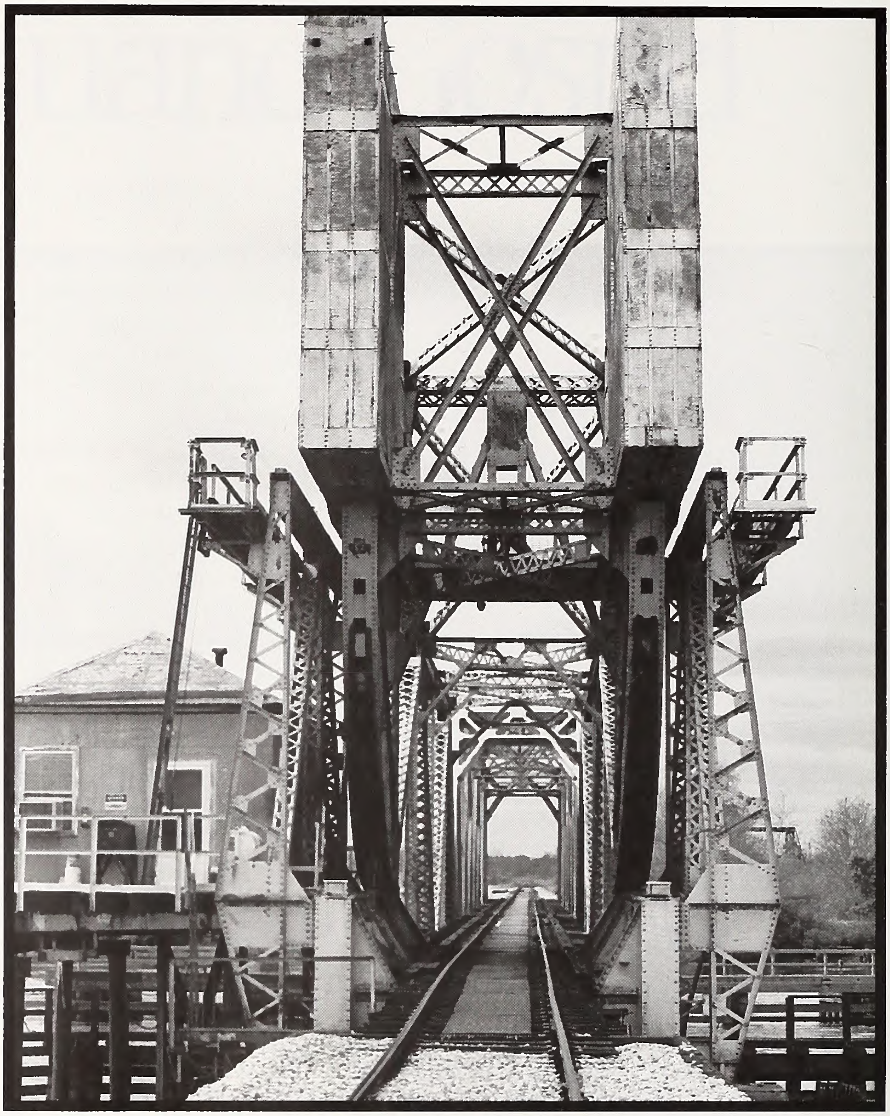
Dogwood Neck. The company still owned much of the local housing, a company store and its own police force, but the black workers also gained a fierce independence by owning land and having regular wages. By the 1920s Navassa was, in Willis' words, "a booming, wide-open town." It had six social clubs, numerous cook shops where the guano workers could buy a meal and trains that stopped four times a day on their way in and out of Wilmington. Other fertilizer companies also located in Navassa, employing as many as 2,000 workers in their heyday.

I haven't found a good description of the inner workings of the guano factories in Navassa, but in 1897 a reporter from the *Wilmington Messenger* toured the nearby Almont Fertilizer Co. and described the factory in some detail. Founded in 1882 by Powers, Gibbs and Co., a British firm that had a monopoly over the sale of Peruvian guano in Europe and North America, Almont occupied a bluff on the Northeast Cape Fear River a couple of miles above Wilmington.

As described by the *Messenger*'s reporter, the factory workers first used mills to grind into powder phosphate rock mined in Florida, South Carolina and Tennessee. Then they separated the phosphate from the silica in great vats of sulfuric acid. The dissolved rock phosphate could be mixed with different combinations of potash, salts, blood, dissolved bone and other ingredients to make a variety of fertilizer brands. Finally, the mixture was dried, lumps were broken up and it was put into bags.

The Almont Fertilizer Co., like most of the local companies, also produced its own sulfuric acid. Working in the "acid factory" was always fraught with danger due to the lethal acid and its fumes, and it must have resembled a scene out of Dante's *Inferno*. The black laborers burned pyrite ores mined in Spain and Newfoundland in two dozen furnaces. "The heat from the fires drives the sulphur from the ore in fumes," the reporter wrote. The fumes condensed into sulfuric acid, which flowed through lead pipes into the fertilizer factory next door.

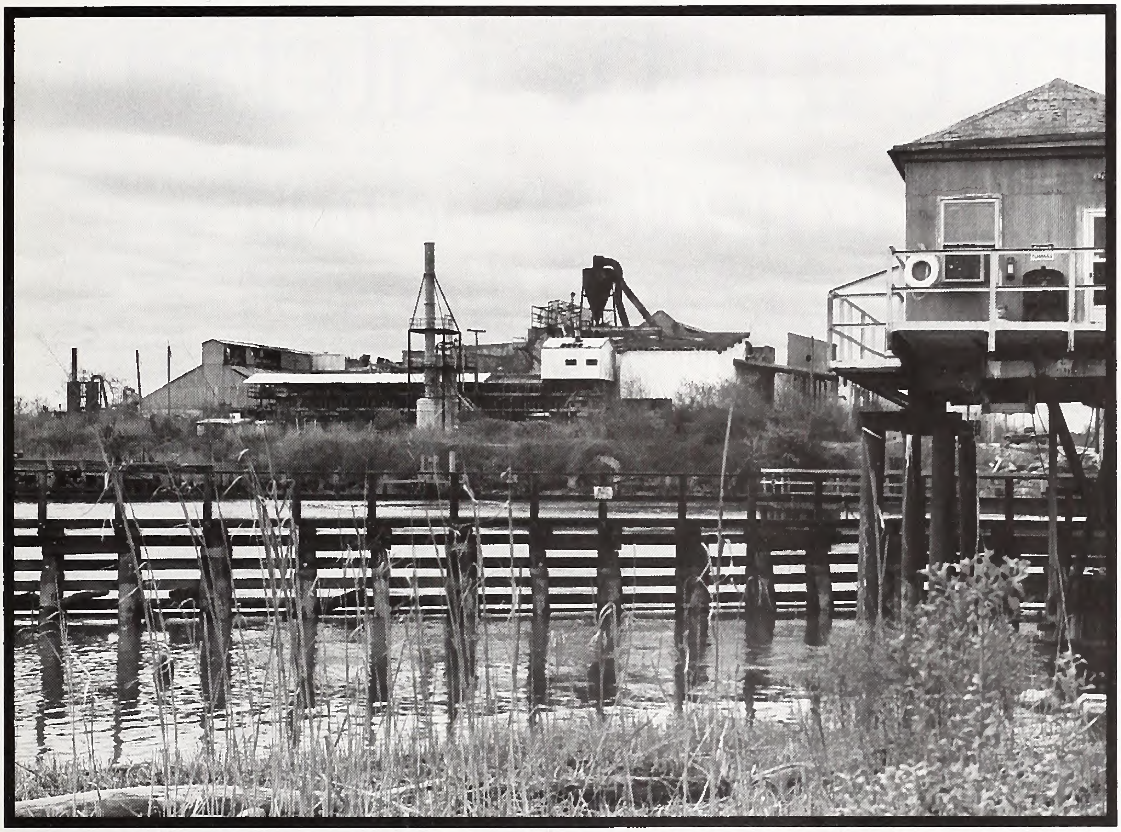

Jeanne Faris Norris

A railroad trestle crosses the Cape Fear River near the remains of the Navassa Guano Co.

The Navassa Guano Co. and the Almont Fertilizer Co. were among more than a dozen fertilizer factories operating in the Wilmington area by 1912. The Pocomoke Guano Co., started around 1910, located its factory in the remote community of Pocomoke, which had first been settled by ex-slaves from a local rice plantation just after the Civil War. Located off U.S. 421 by Carolina Power & Light Co.'s Sutton Steam Plant, the deserted remains of the Pocomoke community have recently been the subject of research by Mariel Rose, an anthropology student at the University of North Carolina at Wilmington.

One of the local people Rose interviewed about Pocomoke was Hortense Moss, whose mother and grandmother fed guano workers out of their kitchens. "They had all the black people that would come over there to work in fertilizer for five dollars a week," Moss recalls her mother telling her. "My grandmother was a cook, and she'd sell a cup of coffee for five cents and a meal for 15 cents."

A bustling village rose by the guano



Jeannie Faris Norris

The Navassa Guano Co. has fallen into disrepair, but the town it built boasts 600 residents.

factory, with its own school, a livery stable, a restaurant, about 20 houses and at least five bunkhouses for unmarried workers. Moss' mother vividly recalled the community life in Pocomoke. "We would get together, cook and talk and eat and have church in each others' home," her mother told her. "They'd go to each others' houses and sing and pray. It stayed that way for years."

Other fertilizer factories depended heavily on the local mining of marl, fossilized seashells rich in a calcium that had the much-desired effect of fixing nitrogen in manured soils. Expansive marl deposits can be found throughout much of the North Carolina coast, and they were first mined commercially just after the Civil War.

G.Z. French's lime and phosphate facility at Rocky Point was perhaps the best-known of these operations. Like many fertilizer pioneers, French got into the business via his agricultural interests. He was an innovative farmer with extensive holdings of truck vegetables, and he continued to farm while he engaged in the fertilizer trade.

A different kind of fertilizer company operated at Cronly, about 17 miles west of Wilmington. Established in 1883, the Acme Manufacturing Co. concentrated on cottonseed oil. According to the *1884 North Carolina Business Directory*, the 10-acre factory complex also made fertilizers out of "peanuts, palm kernels, linseed, flax-seed or any other oil-yielding substance which they can obtain" and experimented with using oil distilled from longleaf pine needles.

Even the menhaden industry was a part of the guano business. According to Barbara Garrity-Blake, author of a fascinating portrait of the menhaden industry called *The Fish Factory*, the name "menhaden" comes from the Native American word *munnawhatteaug*, meaning "that which manures." The menhaden factories in Beaufort, Morehead City and Southport would eventually produce mostly fish meal, an important additive to livestock feed. But into the 1910s and 1920s, the menhaden catch was used principally for oil and guano. By 1907, North Carolina had at least 10 fish factories that processed about 57 million pounds of menhaden, much of it destined for the Navassa Guano Co.

This forgotten tale of our fertilizer industry may not be the most romantic part of our coastal history. We're talking about bird droppings and manure, after all. But that doesn't mean that we should forget it. Countless souls shoveled guano and phosphate rock in our ports. Many others sweated through 12-hour shifts in sulfuric acid factories or trudged through the darkest nights to make the first shift at fish factories and marl mines.

These mostly unremembered workers tried to make a decent living and build a better future. They worked hard, a lot of them died young — and I don't expect many of them got a fair shake. But they're as much a part of our coastal past as anybody. Their stories remind us of how many coastal voices have not yet been heard. And, lest we forget, they remind us that there is often a big story in even the smallest places. ◘

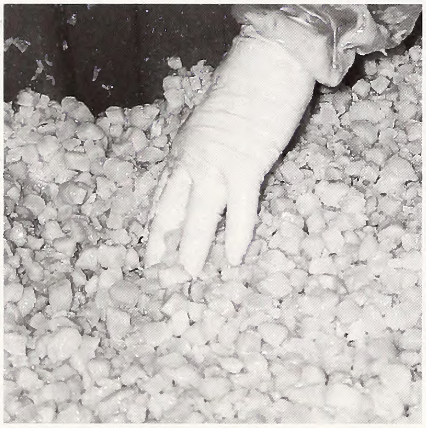
David Cecelski is a historian at the University of North Carolina-Chapel Hill's Southern Oral History Program.

Science in the Kitchen

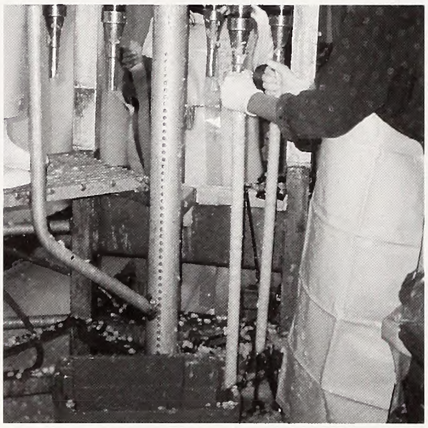
Tasty Technology Behind Scallop Medallions

By Jeannie Faris Norris

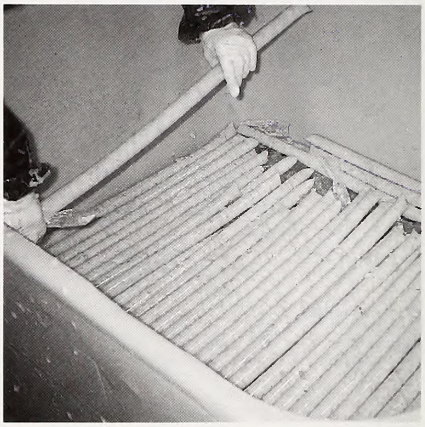
Photos courtesy of the North Carolina State University Food Science Dept.



Small scallops are mixed with a protein gel.



Bound by the gel, the scallops are stuffed into casings.



The casings are chilled for six to 12 hours.

Steak-ums, Chicken McNuggets and Hardee's roast beef sandwiches.

What could these popular fast foods have in common with a sizzling entrée of scallop medallions? They certainly don't share any resemblance in flavor, texture or appearance. But they do have similar origins — each is a marketing masterpiece born of emerging food science technology. Before they were ever introduced to the kitchen, these dishes had to pass muster in the laboratory.

Each of these foods began as a handful of meat pieces that were bound together into a product with a texture and taste similar to the real thing. After all, what's more appealing — chicken pieces or a neat nugget? Tiny scallops or a mouth-filling medallion?

Equal parts science breakthrough and marketing genius, the upscale scallop medallions and convenient fast-food meats are created by a process called restructuring. Until last year, the process was used only when the meat was cooked because the pieces had to be "glued" together by heat processing. As a result, this food has been marketed frozen or precooked to maintain its structure.

And while frozen and pre-cooked meats are fine for fast food businesses, they don't appeal to many restaurateurs and grocery shoppers who want their buys — especially seafood — to be fresh (unfrozen). They want to smell the product and see its color, says Tyre Lanier, a food science researcher at North Carolina State University and a Sea Grant researcher.

"People prefer to buy fresh," says Lanier, who helped develop the technology. "So this really limits how we market these products."

Wanchese Fish Co. knows this better than anybody. The Dare County seafood company launched the scallop medallion on the East Coast when it began looking for ways to market its surplus of small sea scallops.

"It was hard to sell (the smaller scallops)," says David Green, a seafood technologist at NC State University's seafood laboratory. "They couldn't compete with similar products that were coming in from China and other countries."

The solution, offered by NC State University's food science department, was a cold-binding technology that created uniformly sized medallions from scallops naturally only a quarter- to half-inch wide. This meeting of technology and marketing, which can be applied to other types of seafood, was funded through the 1997 Fishery Resource Grant Program administered by North Carolina Sea Grant.

Here's how the system works: The main protein component is fibrinogen, which is found in all muscle food. In this case, it's extracted from beef plasma. When mixed with an enzyme from meat, fibrinogen forms a gel network around the surface of the scallops and holds them together.

"It uses currently available technology, but its successful application in fishery products still had to be demonstrated," says Green.

Because the binder acts at refrigerated temperatures, it doesn't require cooking to make a protein gel. This gel is used to glue together small scallops, and it represents less than 5 percent of the final product.

"This binding chemistry is a very naturally occurring reaction," Lanier says. "We've been studying it for years in surimi-based crabmeat substitutes made from fish. It does exactly the same thing."

Once mixed with the gelling binder, the scallops are stuffed into long casings 1 inch in diameter. Wider casings can be used to produce larger scallops. They're chilled for six to 12 hours and sliced to a prescribed thickness. At that stage, they can be packaged fresh.

"People don't like to eat small pieces of meat," Lanier says. "The beauty of this process is the simplicity of it. It's such a simple thing to do, and yet it adds so much value to the product."

Using this method, food processors can take scallops as small as 120 count per pound and create scallops as large as 30 per pound, says Sam Daniels, director of sales and marketing for the family-owned Wanchese Fish Co. The value of the product is doubled at a small cost to the processor. On the wholesale market, re-formed medallions are sold at $4 to $5 per pound — a better value than single scallops of the same size.

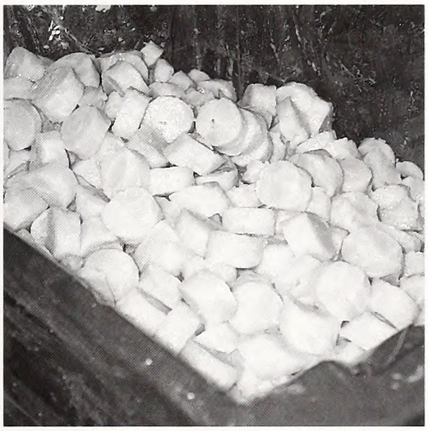
"What we're able to do is increase the value of the product by changing the size of it," Daniels says. "Without the help of North Carolina State University, I don't think we could have made this a successful venture."

Processors can also ensure a consistent quality, shape and size, which is important in the food industry. And the process offers a wider range of tastes because spices and flavors can be added while restructuring the meat. The texture can also be adjusted.

The scallop medallions are sold to food distributors and food services, retail chains and grocery clubs throughout the United States and Europe. They were featured in March at the International Boston Seafood Show, the largest seafood trade show in the world, which attracts more than 1,100 exhibitors and 20,000 seafood professionals to sample, compare and buy seafood products and services.

The diameter of the casings determines the scallops' width.

The scallops are cut to a prescribed thickness.



The result: thick medallions that can be sold fresh.

This blending of technology and marketing is one of the many success stories funded through the Fishery Resource Grant Program, which pays qualified applicants to research their ideas about improving fishery resources. The General Assembly funds the program each year, setting aside $1 million for citizen studies.

This research has supported a master's thesis by Kim Baker, a graduate student at NC State University's food science department. Meanwhile, Lanier is experimenting with ways to restructure trimmings and small pieces of crab and fish meat, and he's studying the use of proteins other than beef fibrinogen. Among them is casein from milk, the main protein found in coffee whiteners. ◘

Preserving the Past

Karen Amspacher Holds onto Harkers Island Heritage

By Odile Fredericks • Photographs by Scott D. Taylor

Karen Amspacher works to preserve Harkers Island heritage as the island is overtaken by new development.

On a bleak winter day, Karen Willis Amspacher stands, tears in her eyes, looking out across Core Sound at Shackleford Banks, a pencil gray line on the horizon.

She has just turned away from a sight that makes her blood boil. For a moment, she retreats into a memory of the close-knit life here on this spot of Harkers Island decades ago, when her grandmother and neighbors all had boats docked a few feet from their homes.

Behind her, family graves lie in the sandy soil on a small patch of land that she says is the only remaining piece of her grandmother's property she can afford to own as real estate prices skyrocket. Within a few feet of the graves, which she has enclosed protectively in yellow rope, red flags signal a new landowner's intentions to build.

"I can't afford to live here, but I'll be buried here," she says, then looks to a nearby cluster of windswept oaks whose contorted forms are hauntingly beautiful. "The trees are so pretty. I can't blame these people for wanting it."

As development begins to engulf this small island in Carteret County, Amspacher has emerged as a preserver of its vanishing heritage. A mother, wife and former teacher, she has managed to galvanize financial and community support for a museum in the most unlikely of places — a rugged swamp island, once mostly inhabited by boatbuilders and fishers. In

Curt Salter is an island resident who keeps alive the rich tradition of decoy carving.

"What goes on in that kitchen is more than carving. It's keeping a community together and has brought about a whole lot of pride in being who we are and how we came to be."

the process, she has rekindled a sense of pride for natives like herself whose island brogue she says inspired ridicule when she was a child in school.

Few communities, especially rural ones, ever build museums, and then they usually start with a benefactor, says Wayne Martin, folklife director for the North Carolina Arts Council.

"Now they're doing something that is absolutely amazing, and that is building the Core Sound Waterfowl Museum," he says. "This is unbelievable. If you look over our state, I can't think of another place at this time in this day in this age, when a community as small as Harkers Island is doing this — it's phenomenal."

Now operating out of a small house and exhibiting mostly the work of local decoy carvers, the Core Sound Waterfowl Museum is expected to move to a 16-acre site leased from Cape Lookout National Seashore on the island's east end in 1999. As director of the museum, Amspacher was instrumental in pushing for the project and helping to raise more than $1.3 million to build it. With most donations coming from working people giving between $100 and $1,000, the museum is a testament to both the community's devotion to its heritage and Amspacher's undaunted spirit.

The museum will showcase the talents that once supported Harkers Islanders' existence — the making of decoys, hunting, fishing, boatbuilding — a way of life and its traditions. Its shape — with an outdoor pond where visitors will be able to watch wildlife, then step indoors to see decoy carving or savor the island's flavor in the kitchen — reflects Amspacher's vision and yearnings to preserve the Down East way of life she knew as a child growing up on the island.

A 42-year-old mother of two, Amspacher is a force to be reckoned with, persistent and tireless, expecting no less from others. Like the trees that grow on the island, she gains strength from her native soil. In a time when everybody seems on the move, Amspacher tries to hold onto a simpler era while reshaping the future for islanders.

"My heart wants to blow up the bridge, turn out the lights and tell everybody to go home — but I know we can't do that," she says. "So my mind says, 'Karen, here are the facts: The people are coming anyway.' People are on the move, they're looking for places like Harkers Island, and if we don't tell our story, somebody will come and tell it for us."

Born into a family that for generations built boats and fished, Amspacher remembers being inspired by the tales of her whaler uncle and by nights spent camping out on Shackleford Banks. Then, as now, families on Harkers Island lived close to one another, a fiercely independent people, yet dependent on one other emotionally, she says.

She compares the character of Harkers Islanders to those of North Carolina's mountain people. Once, she drifted away from home to the mountains of Boone, where she worked three jobs at

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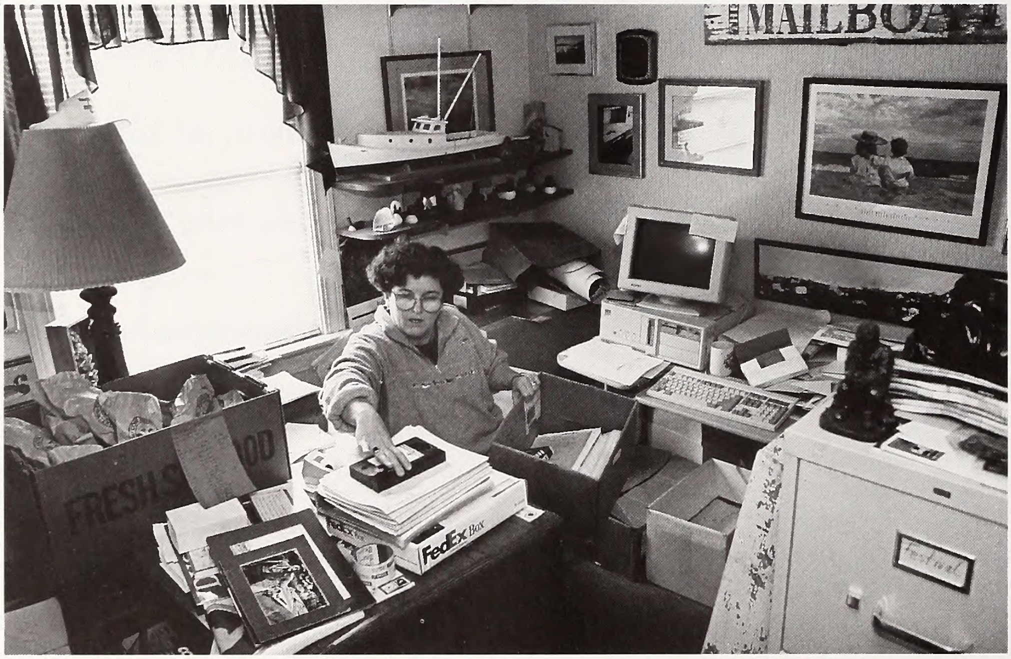
the same time to put herself through Appalachian State University. Working in the university's oral history department, she first acquired a taste for heritage work there. She eventually returned home to marry and now lives in a mainland house that's been in her family more than six generations. She's never left again.

On Harkers Island, she was pulled into preservation through her church, and her stamina has carried her this far. She describes herself as "hyper" and "aggressive," and she knows that she drives people to their limits.



From her office in the museum, Amspacher works to preserve the island's past and shape its future.

When the women in her church asked her to organize a bazaar, she proposed they meet weekly for craft classes to share skills and creative talents. The first sale of their goods pulled in $7,200; however, the women flatly refused to have another bazaar, she recalls.

"I was crushed," she says. "They were worn out. I had worked them too hard."

She then turned her sights to helping them compile a local cookbook. Again, she turned that venture into more than an exchange of recipes when she invited a local oral historian friend to teach the women how to interview their families before she dispatched them with tape recorders.

Pregnant and sick to her stomach, she ferried the cookbook to the printer as each section on the island's history was pieced together between the recipes. People would show up at the church on Monday nights just to see what was being collated that week, and the effort brought the community together, she says.

"The night we put the first book together we cried," she says, her voice breaking. "It felt like us, and it was us. Being from Harkers Island had always been something you had to kind of bear — because we were a small community, and we talked funny, and it was like being from the wrong side of town. It was a different culture."

From the *Island Born and Bred* cookbook, which she hawked driving up and down the coast in her red Plymouth Voyager — often with kids in tow — she went on to edit a range of heritage publications. She is editor of *The Mailboat*, a newsletter filled with history and reminiscences of locals that comes out when she has time, and the *Core Sounder*, the newsletter for the carvers guild and the waterfowl museum. She brought history and environmental awareness to the Seafood Festival in Morehead City so that people could learn the traditions of the fishers whose catch they enjoyed and the importance of the environment to the future.

As head of the museum, she is in charge of promoting the Core Sound Decoy Festival, which attracted 10,000 people to the island last year. She also won grants from the North Carolina Arts Council to document storytelling on the island and to capture its fiddle and gospel music. She went out herself to do some of the interviewing.

Sitting in a cramped room of the current museum, Amspacher appears worn out. She has attended the funerals of several local residents that week and written moving obituaries for them, another of her responsibilities. But when she talks about Harkers Island natives or the museum, her enthusiasm wells up.

"What goes on in that kitchen is more than carving," she says, referring to a group of men in the room next door who are cheerfully whittling away at wood. "It's keeping a community together and has brought about a whole lot of pride in being who we are and how we came to be."

Still, somewhere in the back of her mind, a nagging thought remains that she's fighting a losing battle. She wants to build the museum so that, 50 years from now, people will know the area was more than a place to buy a summer home.

"(So they'll know) that there was a community of people who were very talented, very determined and very conscious of where and who they were ... and that they held on to it for as long as they could." ■

MARITIME
MORSELS

Spicing It Up

By Kathy Hart

If you think the spice section at your local supermarket has expanded, you're absolutely right.

Along with the standard cinnamon, nutmeg, cloves, basil and oregano, supermarkets now regularly stock once hard-to-find spices such as tarragon and coriander and spice blends as varied as Cajun blackening seasonings or apple pie flavor. In the produce sections of larger supermarkets and specialty food stores, consumers can often find the intense flavor of fresh seasonings — rosemary stems, dill sprigs, sage leaves and ginger root.

Spicing up your meals isn't just about parsley and pepper anymore.

What's behind the growth? Greater ethnic diversity in this country and a world made smaller by air travel and global media.

Today, Americans' culinary cravings hail from almost every country in the world — from Albania to Zanzibar. Everything from history to religion to availability figures into how a country's cooks use spices to develop distinctive flavors that distinguish their cuisine from that of their neighbors. And almost all of these ethnic cuisines have been introduced in the United States through an international smorgasbord of restaurants, cookbooks, magazines and cooking shows.

Health professionals are on the spice bandwagon too. In an effort to convert Americans to diets low in sodium, cholesterol, fat and calories, doctors and dietitians encourage cooks to substitute spices for salt,

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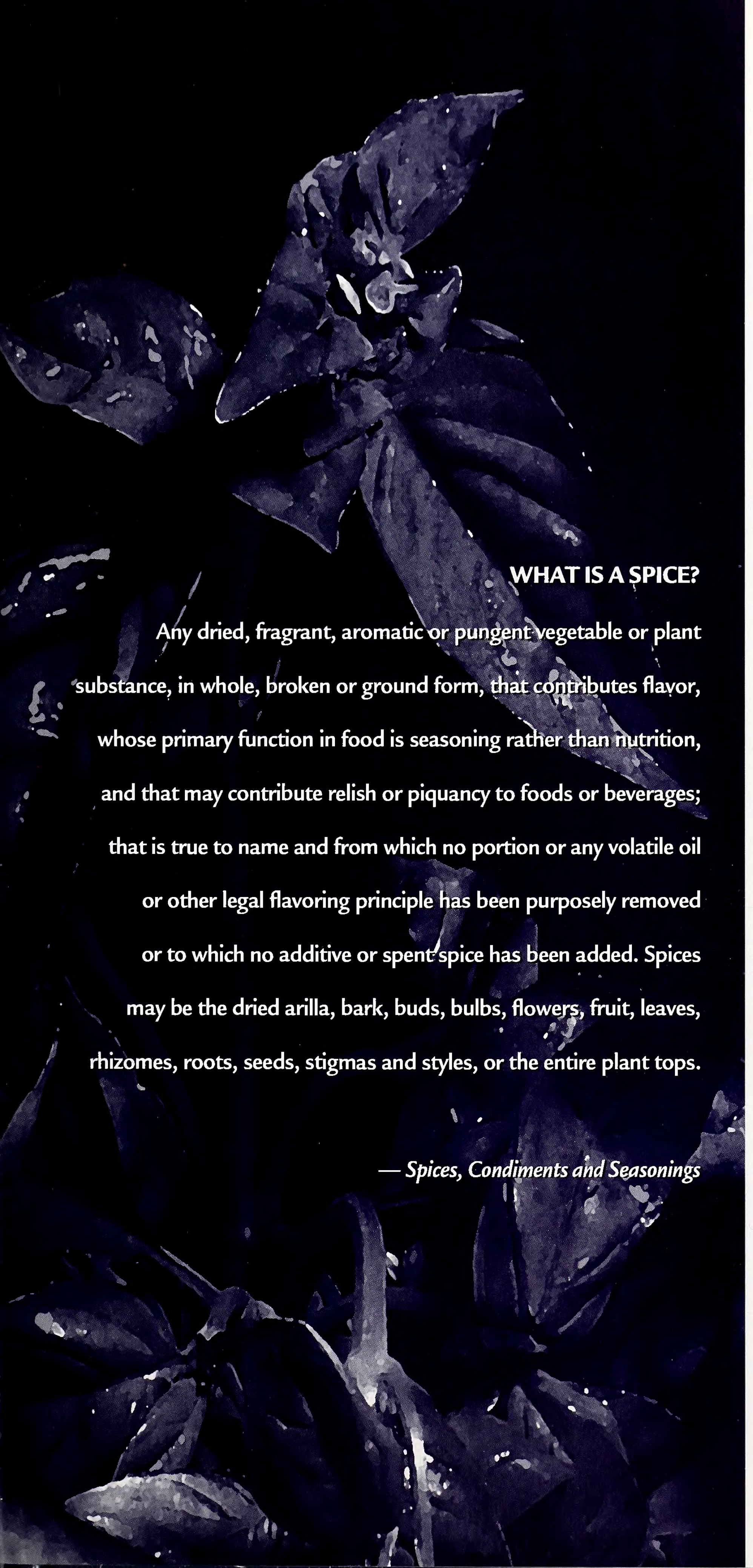


WHAT IS A SPICE?

Any dried, fragrant, aromatic or pungent vegetable or plant substance, in whole, broken or ground form, that contributes flavor, whose primary function in food is seasoning rather than nutrition, and that may contribute relish or piquancy to foods or beverages; that is true to name and from which no portion or any volatile oil or other legal flavoring principle has been purposely removed or to which no additive or spent spice has been added. Spices may be the dried arilla, bark, buds, bulbs, flowers, fruit, leaves, rhizomes, roots, seeds, stigmas and styles, or the entire plant tops.

— *Spices, Condiments and Seasonings*

butter and margarine. Instead of preparing bland health food, cooks can look to the spice rack for intense flavor without adding pounds, clogging arteries or raising blood pressure.

But when it comes to spicing your food, knowledgeable cooks caution that a little goes a long way. The intensity of each spice and herb differs, and its effect on different foods varies. It's best to start with a small amount of a spice and adjust after tasting. Use 1/4 teaspoon for four servings, per pound of meat/poultry/seafood or for each pint of sauce/soup/other liquid. For cayenne and garlic powder, start with 1/8 teaspoon. Red pepper intensifies as it cooks, so use small amounts and allow the flavor to build.

Fish and shellfish, already low in fat and cholesterol, offer a canvas on which cooks can paint a palette of spicy flavors. Dill is a natural for salmon. Garlic can flavor almost any fish or shellfish. Crab or shrimp boil spices — a mixture that lends a peppery savoriness — have long been used to season blue crabs, shrimp and crayfish. And what Southerner hasn't dipped steamed oysters, boiled shrimp or fried fish in a cocktail sauce flaming from the heat of horseradish?

But these spices are the tried-and-true flavor enhancers. Americans are now reaching for more exotic seasonings. At the urging of doctors and dietitians and with the help of innovative chefs and cookbook authors, many people are forsaking fried seafood for a spicier catch. They have begun to season the ocean's bounty with spices once associated with other meats and ethnic cuisines — cumin, ginger, oregano, thyme, tarragon, cilantro, marjoram, parsley, cayenne, rosemary, sesame seeds and lots of pepper.

Cooks introduce these flavor enhancers by soaking their seafood in seasoned marinades, patting on spicy rubs, spreading on tangy pestos or spooning savory sauces and butters over the catch of the day. Alternatively, cooks can keep it simple — salt and pepper before baking, broiling, grilling or steaming — but add flavor with condiments such as chutneys, salsas or mayonnaises.

The possibilities for preparing a spicy catch are endless. But you should keep in mind a few tips before you reach into your spice cabinet.

FRESHNESS

- To ensure freshness, check spices annually. Spices and herbs lose their color, taste and aroma over time.
- Look for loss of color.
- Crush a small amount of the spice in your hand and smell it. If the aroma isn't rich and immediate, then the spice has probably lost its potency.
- Try touching a small amount of the herb or spice to your tongue for the ultimate taste test.
- Generally, whole herbs and spices have a longer shelf life than their ground counterparts.

ADDING SPICES TO YOUR FOOD

- Spices should be used to enhance the natural flavors of food and not to disguise off-flavors. A few spices can complement a dish, but too many can overpower it, so be selective.
- Use a dry spoon to remove dried spices from their containers.
- Do not sprinkle seasonings directly from their containers into steaming pots of food. The rising moisture may lessen the potency of the spice or cause it to clump or spoil.
- Crush leaf herbs, such as oregano, thyme or basil, in your hand before use for a more immediate, intense release of flavor. Finely chop fresh herbs for maximum flavor.
- Add herbs near the end of cooking for more distinct flavor or at the beginning for a more blended taste.
- Ground spices and herbs release their flavor easily. In long-cooking dishes, such as soups or stews, add these near the end of the cooking time to reduce the "cooking off" of flavors.
- Whole spices and bay leaves release their flavor slowly, making them ideal for use in longer-cooking dishes. To make it easier to remove these whole-flavor enhancers, tie them in cheesecloth or place them in a tea ball before adding them to the food.

STORAGE

- To preserve peak flavor and color, store spices and herbs in airtight containers in a cool, dry place, away from bright light, heat or moisture. Avoid storing them too close to the stove, oven, dishwasher or refrigerator, where rising steam or heat can reduce their flavor.
- Refrigerate red-colored spices such as chili powder, cayenne pepper and paprika to prevent loss of flavor and color.
- Refrigerate or freeze oil-rich seeds, such as poppy and sesame, to prevent them from becoming rancid.

SOME SPICY HISTORICAL FACTS

As intriguing as a Robert Ludlum novel, the history of spices is flavored with battles, conquests, romance and fortunes lost and won. Spices have been used not only as flavorings, but also as medicines, perfumes, love potions and incense. Here are a few historical tidbits to season your knowledge base:

- The first evidence of spice use comes from the artwork and writings of ancient civilizations. Hieroglyphs in the Great Pyramid at Giza show workers eating garlic and onions for strength.
- The ancient Egyptians used spices — anise, sweet marjoram and cumin followed later by cinnamon, cassia and cloves — for embalming and burying the dead. Jesus was buried in linen cloth anointed with spices.
- There are more than 60 references to spices in the Bible's Old Testament. In Genesis, Joseph's older brothers sold him to a passing caravan of spice merchants. Later, in I Kings, the Queen of Sheba

made a tribute to King Soloman with spices, gold and precious stones.

- About 400 B.C., Hippocrates, the Greek physician, listed more than 400 medicines made with spices and herbs, about half of which we use today.
- The Arabs controlled the spice trade for centuries (3000 B.C. to 200 B.C.), keeping secret for generations the native lands where spices grew.
- For the next 1,400 years, the Romans monopolized the spice trade. After Nero kicked his wife Poppaea to death in A.D. 65, he used an entire year of Rome's cinnamon supply to bury her.
- When the Goths captured Rome in 410, they demanded 30,000 pounds of peppercorns along with gold, jewels and silk to spare the lives of the people.
- In the Middle Ages, a pound of mace could buy three sheep, an ounce of cardamom was worth a poor man's yearly wages and a cupful of peppercorns could buy a serf's freedom.
- Marco Polo's exploration of China finally opened Europeans' eyes to the true source of spices and set into motion the search for an easier, faster route to the Orient. The momentous voyages of Christopher Columbus, Vasco de Gama and Ferdinand Magellan were spurred by the search for spices.
- Between the 15th and 17th centuries, Spain, Portugal, England and Holland fought for control of the spice trade.
- Americans entered the spice fray in the late 1600s. Elihu Yale, a Boston-born former clerk of the British East India Co., started his own spice business. He made a fortune that he later used to found Yale University.
- As immigrants poured into America, they brought their love for their own ethnic dishes, and America's demand for spices expanded. Today, the United States is the world's top spice buyer.

Spicy Spoonfuls

MACKEREL WITH HERB SEASONING

- 4 medium mackerel or other fillets
- 1/4 cup unsalted margarine, melted
- 1 tablespoon fresh lime juice
- 1/8 teaspoon Tabasco sauce
- 1 tablespoon minced fresh parsley
- 1 teaspoon minced fresh thyme
- 1 teaspoon minced fresh marjoram
- 1/2 teaspoon pressed garlic
- 1/4 teaspoon cayenne pepper
- 1/4 teaspoon paprika
- 1/8 teaspoon ground cloves
- 1/2 cup coarsely chopped green onions, including tops

Combine melted margarine, lime juice and Tabasco. In a small bowl, combine all seasonings except onions. Place fillets in greased baking dish. Brush margarine mixture over fillets. Sprinkle onions on fillets, then herb seasonings. Bake at 400 F for 15 to 20 minutes or until fish flakes easily when tested with a fork. Serves 4.

LIME-MARINATED SNAPPER WITH CILANTRO BUTTER

- 4 medium snapper or other lean fillets
- 3 1/2 tablespoons fresh lime juice
- 1/2 cup unsalted margarine
- 2 cloves garlic, pressed
- 3/4 cup fresh cilantro, finely chopped
- 1/2 teaspoon dried red pepper flakes
- lime wedges

Place fillets in baking dish or nonreactive pan and pour lime juice over them. Marinate 20 minutes, turning once.

Melt margarine in small, heavy saucepan over medium heat. Add garlic and cook 1 minute. Mix in cilantro and pepper flakes and cook until cilantro is heated through, about 1 minute. Brush over fish. Broil about 4 inches from heat until fish flakes easily when tested with a fork, about 8 to 10 minutes. Garnish with lime wedges. Serves 4.

SCALLOPS WITH LEMON AND DILL

- 1 1/2 pounds scallops
- 2 tablespoons unsalted margarine
- 2/3 cup dry vermouth
- 1 tablespoon fresh lemon juice
- 1/2 teaspoon finely grated lemon peel
- 1/4 cup chopped fresh dill
- 1/4 teaspoon freshly ground black pepper

If using sea scallops, cut into halves or quarters. In large skillet, melt margarine over medium heat. Add scallops and stir until almost opaque, about 4 to 5 minutes. Remove scallops from skillet. Add vermouth, lemon juice and lemon peel to skillet and boil until reduced to a thick glaze, about 5 minutes.

Return scallops to skillet and stir until thoroughly heated. Add dill and pepper. Serves 6.

Recipes taken from No-Salt Seafood: All the Flavor Without the Salt. *To purchase a copy, send $3.50 to North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. Ask for publication UNC-SG-89-07.*

Fishing Fever

By Debbi Sykes Braswell

You've pored over fishing magazines this winter until you memorized which side of the page your favorite rods and lures are on. You and your friends have trotted off to all the tackle shows in a five-county radius. Maybe you even bought a boat you're itching to try.

You've got the symptoms, and there's no doubt about the diagnosis. It's a double whammy case of spring fever crossed with fishing fever.

But don't worry — you won't mind the prescription at all. Now that spring has finally pushed past winter, it's time to indulge in some casting and trolling.

You'll find lots of good action, no matter where you go on the coast or what kind of fishing you like, says Jim Bahen, a Sea Grant fisheries agent. But a couple of species are an especially good catch this time of year.

LITTLE TUNNY

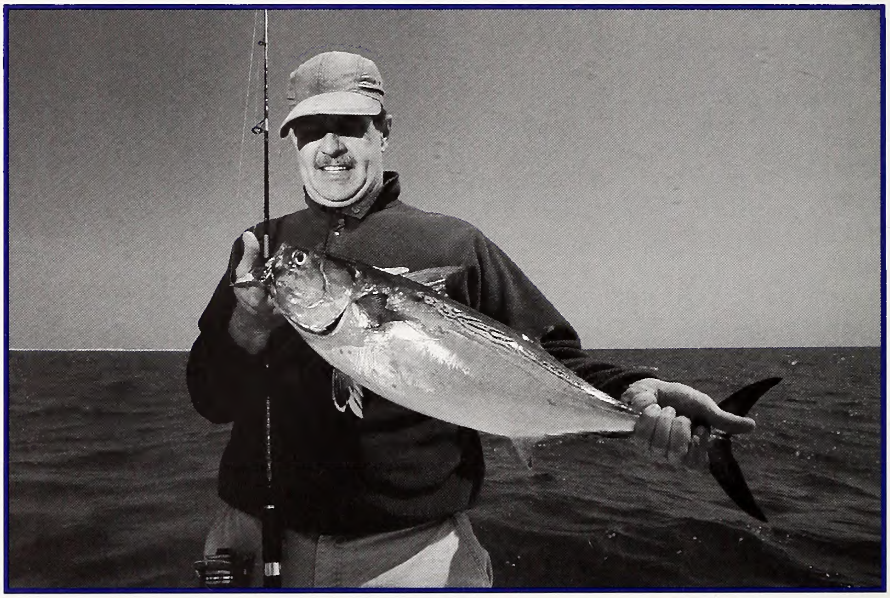
Also known as false albacore or spotted bonito, these fish are hardy enough to brave the cold waters off the North Carolina coast in the springtime. That endurance is important because, even though it's getting warmer on land, the water temperature is only in the mid- to upper-50s.

"When the water starts warming up, they disappear — they move up the coast," Bahen says. "If you don't catch them in the months of May or June, they're gone."

Although you might catch little tunny from the surf or a pier on rare occasions, your best bet is to go after them in a boat. Use light to medium tackle and a flyrod or a spinning rod. Try artificial lures such as feathers, jigs or weighted flies.

Once you're in the water, look for the unmistakable commotion that schools of little tunny generate as they feed. "There's water splashing everywhere, gulls diving, and the tuna are rolling on the surface, diving on schools of bait," Bahen says.

Besides being a good fighter in the water, little tunny make for good tuna salad on shore, Bahen says. The key is to bleed and chill them, like you would any other tuna.


Joel Arrington

This spring, try your hand at catching a littly tunny, also known as false albacore.

There are no regulations on catching little tunny, but Bahen encourages fishers to catch what they want and release the rest. "We need to preserve and protect and try to conserve," he says.

BLUE MARLIN

The huge marlin and the little tunny have at least one thing in common — they are pelagic fish that roam the ocean. But the blue marlin doesn't have the cold tolerance of the little tunny.

To hook one of these giants — which are the largest of the billfish — you'll have to travel 30 to 50 miles from shore to reach the Gulf Stream, where the water temperature is typically 75 to 82 degrees.

Blue marlin migrate past the North Carolina coast this time of year, when many marlin tournaments take place.

In times past, crowds would gather on the docks to ooh and ahh at the gigantic specimens that fishers brought back during the tournaments. But these days, Bahen says, the trend is to measure the fish on board, take photos or videotape them and then release the marlins.

"It's a terrific fighting fish," Bahen says. "It's been that way since Zane Grey and Ernest Hemingway wrote about them."

At one time, North Carolina held the world record for the largest blue marlin ever caught — a 1,142-pound whopper hooked in Oregon Inlet in 1974. But as boats have gotten bigger and anglers have explored the oceans worldwide, Bahen says, the Tar Heel coast is no longer known as the blue marlin capital of the world.

Not that there aren't some impressive marlins swimming our waters. To go after one, be prepared with the right equipment out of consideration for the ultimate survival of the fish. You'll need a big reel and 50- to 100-pound-test monofilament line.

Battling a blue marlin can sometimes take hours, and you can unnecessarily prolong the experience if you aren't outfitted correctly, Bahen says. The more exhausted the fish becomes, the less likely it is to survive once you release it.

"You don't go bear hunting with a switch, and you don't go blue marlin fishing with a spinning reel," Bahen says.

The best approach is to troll the bait, and the kind of bait you choose is personal preference, Bahen says. Some fishers use artificial lures and others prefer natural bait such as Spanish mackerel or mullet.

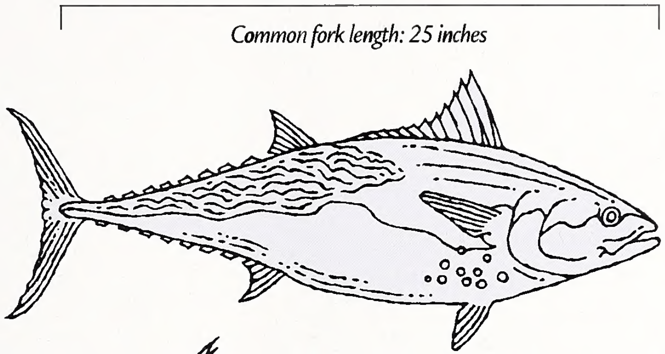
Fishers can kill only one blue marlin per day, and the fish must be at least 86 inches long in fork length (from the lower jaw to the fork of the tail.)

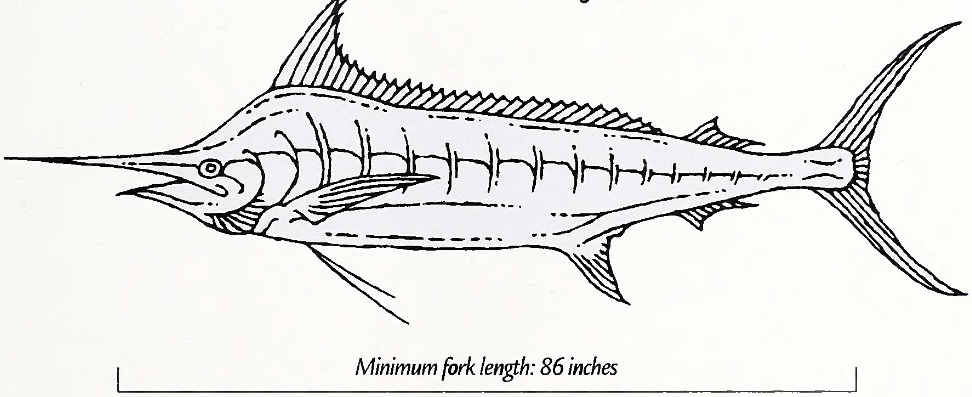
"They are big, giant, beautiful fish," Bahen says. But the important thing for fishers is to come home with a good picture in mind. "We want that picture to end right, to see that fish swim off to fight again."

For more tips about the little tunny or blue marlin, call Jim Bahen at 910/256-2083.

little tunny, *Euthynnus alletteratus*

Ranges: Tropical and subtropical waters on both sides of the Atlantic, including the Mediterranean, Caribbean and Gulf of Mexico. ***Average catch weight:*** 6 to 8 pounds





blue marlin, *Makaira nigricans*

Ranges: Deeper, warmer waters of the western Atlantic, usually no farther north than Virginia Beach, Va. ***Average catch weight:*** 300 to 500 pounds

1998 North Carolina Saltwater Fishing Tournaments

- May 14–16 *Cape Fear Blue Marlin Tournament*, Wrightsville Beach, 910/452-9774
- May 16–17 *The Carolina/Kure Beaches Spring Surf Fishing Tournament*, Carolina Beach, 910/458-8434
- May 23–24 *Swansboro Rotary 1998 Memorial Day Blue Water Fishing Tournament*, Swansboro, 919/354-2787 or 910/326-1211
- May 23 *Pirate's Cove Memorial Weekend Tournament*, Manteo, 252/473-3700 or 1-800/367-4728
- June 8–13 *Big Rock Blue Marlin Tournament*, Morehead City, 252/247-3575
- June 15–20 *Hatteras Annual Invitational Blue Marlin Tournament*, Hatteras, 252/986-2454
- June 20–21 *14th Annual Raleigh Saltwater Sportfishing Club King Mackerel and Blue Water Tournament*, Atlantic Beach, 919/556-0726
- June 26–27 *E.J.W. Cobia Tournament*, Morehead City, 252/247-4725
- July 4 *Jolly Mon King Mackerel Tournament*, Ocean Isle Beach, 910/754-6000 or 910/754-8416
- July 10–11 *70 West Marine Billfish Tournament*, Morehead City, 252/726-5171
- July 11–12 *The East Coast Got-Em-On Classic*, Carolina Beach, 910/458-6729
- July 12 *Seamark Foods Children's Tournament*, Manteo, 252/473-3700 or 1-800/367-4728
- July 18 *Carteret County Sportfishing Association Ladies King Mackerel Tournament*, Beaufort
- July 25-27 *Carteret County Sportfishing Association King Mackerel Tournament*, Beaufort

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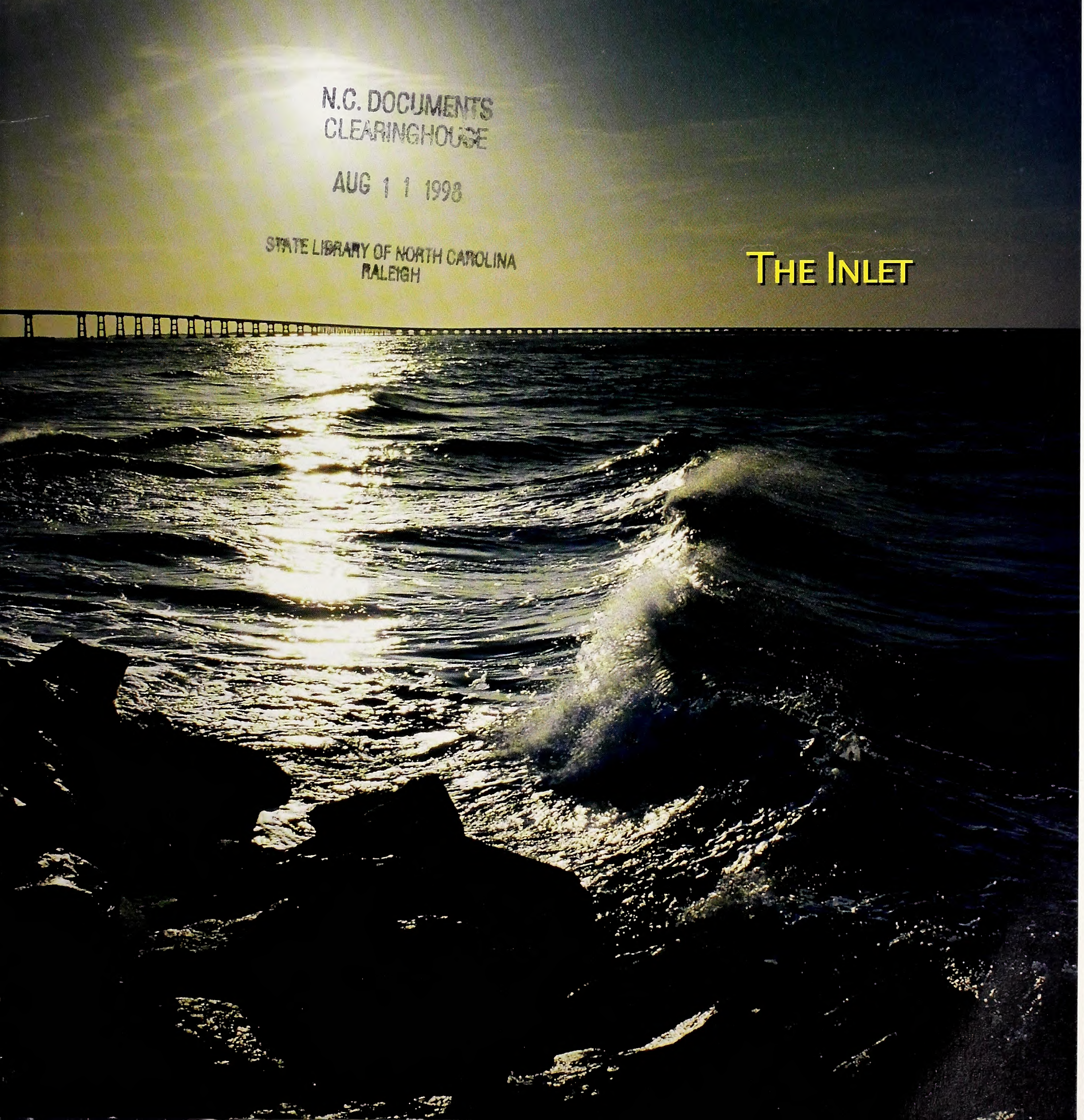

From the Editors

Who We Are

Each month, *Coastwatch* brings you stories about the North Carolina coast. Any topic is game, whether it's the best way to fish for speckled trout or the most recent developments in marine biotechnology. Our mission is to help you catch the latest ideas, human interest stories, research, news and events on the coast. Often, we mention North Carolina Sea Grant, the program that publishes the magazine, and discuss the work of its scientists and agents.

But what exactly is Sea Grant?

North Carolina Sea Grant is a university-based program that promotes the wise use and stewardship of coastal and marine resources through research, outreach and education. It is one of 29 programs involving more than 200 universities in the coastal and Great Lakes states, as well as Alaska, Hawaii and Puerto Rico. This network has a reach that extends over the entire country — and the world. Members of the network often team up to tackle regional and national problems that are beyond the scope of a single state program.

This year, the National Sea Grant Program is celebrating its 30th anniversary. Over the past three decades, the program has achieved important advances in many fields. North Carolina Sea Grant, which joined the national network in 1970, has contributed to this success with a number of achievements, including hybrid striped bass production, an industry that has developed in just a decade into a $3.5 million-a-year moneymaker for the state.

We accomplish important scientific work by assembling teams of researchers from the state's top universities to investigate issues such as harmful algal blooms (see story on page 14), declines in fisheries stocks, habitat degradation and coastal erosion. The findings from Sea Grant projects are applied from Currituck to Calabash and beyond state lines.

Sea Grant extension agents take the information to folks whose lives are affected by it or depend on it. They are down on the docks adjusting a net to reduce bycatch, at the crab house testing cooking pressures, under a beach cottage examining hurricane tie-down straps and in the marsh giving teachers a lesson in estuarine ecology. They bridge the gap between scientists and the coastal community, alerting researchers to problems and needs and transferring research results back to the public, local officials and resource managers.

And the communications team, which is responsible for *Coastwatch*, produces books, videos, brochures and media releases to let the public know about the program's important research and extension activities.

None of this work would have been possible without the vision of Athelstan Spilhaus, a geophysicist, meteorologist and inventor who in 1963 proposed sea-grant colleges to parallel the successful land-grant universities already in place. Sea Grant's founding father watched his brainchild flourish for its first 30 years, but he died in March at age 86. He left a legacy of dedication, cooperation and innovation.

Sea Grant has a mission to preserve our coastal and marine resources while finding ways to use them judiciously. It is a program that aims to build a better tomorrow for the North Carolina coast.

That's who we are. ▫

Jeannie Norris

Daun Daemon

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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for $15 by the North Carolina Sea Grant College Program, Box 8605, North Carolina State University, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: faris @unity.ncsu.edu or ddaemon@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of
Oregon Inlet
by Scott D. Taylor

Table of contents photo of
boats in Wanchese Harbor
by Scott D. Taylor

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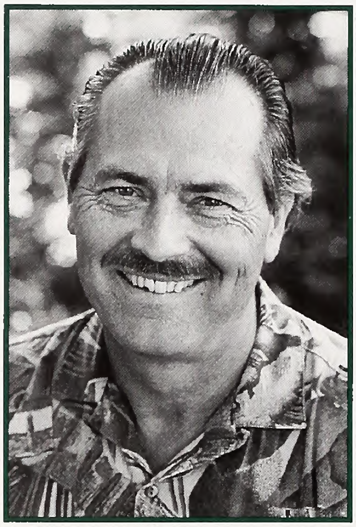
COASTAL *TIDINGS*

New Sea Grant Director Encourages Involvement

North Carolina Sea Grant has a new director at the helm. Ron Hodson was named to the post effective July 1, and his first order of business is improving community and university input into the program's priorities.

Hodson was named interim director in January 1997 after the resignation of B.J. Copeland, who led the program for more than two decades. For 17 years, Hodson was associate director of Sea Grant, a university-based program that fosters the wise use, conservation and development of coastal resources through peer-reviewed research, education and outreach.



Ron Hodson

"North Carolina Sea Grant has been one of the best Sea Grant programs in the country under the leadership of B.J. Copeland," Hodson says. "Our goal is to be that good and better."

Hodson says he will go to extra lengths to ensure that citizens and researchers are involved in setting the program's course. His first step is to establish advisory boards for outreach and research.

"It's going to be inclusive, and it's up to them — the citizens of North Carolina — to help us decide what we should be concerned about in this state and what issues we should be studying," he says.

People can share their ideas and concerns by contacting Sea Grant agents, volunteering on the advisory boards or attending Sea Grant workshops to discuss the issues affecting coastal North Carolina. Later this year, Sea Grant will hold workshops on its five subprogram areas: aquaculture, coastal studies, estuarine studies, fisheries and seafood technology. The public and researchers will be invited to attend.

"We will invite the outreach and research advisory boards and the general public to discuss each area so that we come out of there with the top priorities for the state of North Carolina," Hodson says. "Each of our program areas will get individual treatment."

Hodson says Sea Grant will continue the type of research that helps resource managers make good decisions and maintains the quality of life on the coast. For instance, information about how to better manage harmful algal blooms will benefit homeowners, tourists, fishers and people who enjoy the natural resources.

Educated as a fisheries biologist, Hodson received his Ph.D. from Texas A&M University in 1973. He has been instrumental in conducting the research and developing the technology used to establish the pond culture of hybrid striped bass in North Carolina and throughout the United States.

Hodson has served as president of the U.S. chapter of the World Aquaculture Society and the Striped Bass Growers Association, which he co-founded. He has received funding for more than 18 research projects, authored or co-authored more than 30 scientific publications and directed more than eight graduate students at North Carolina State University. ◘

— J.F.N.

Restoring Shellfish Waters

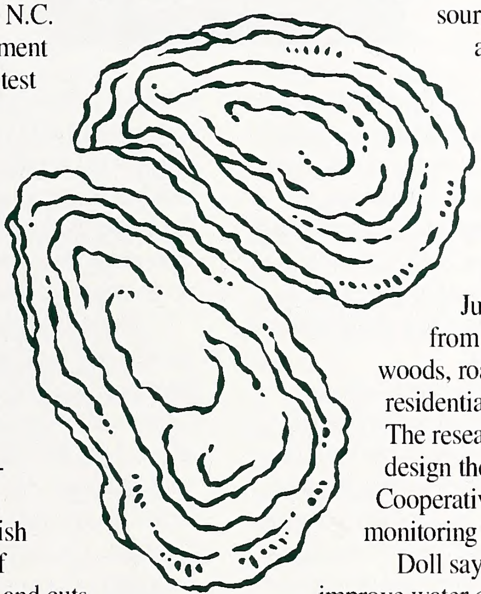
Bacterial contamination has permanently closed about 56,000 acres of shellfish waters in North Carolina, and another 45,000 acres are temporarily closed by rainfall and runoff.

Once shellfish waters are contaminated, can they be cleaned up?

Barbara Doll, North Carolina Sea Grant's water quality specialist, is researching the answer to that question. With a grant from the N.C. Clean Water Management Trust Fund, Doll will test different stormwater management strategies and their effectiveness in reopening shellfish waters at Jumping Run Creek, a tributary of Bogue Sound in the White Oak River basin near Morehead City.

"We will demonstrate whether we can actually restore shellfish waters," Doll says. "If someone digs ditches and cuts down trees, they change the way the watershed drains. Can we fix it so that so much bacteria doesn't wash into shellfish waters?"

Jumping Run Creek is a "conditionally approved closed" tidal creek where shellfish harvesting is permitted only during very dry periods — just a few days per year. Shellfish areas are closed by the presence of fecal coliform, a harmless bacteria that resource managers use as an indicator of dangerous pathogens from animal or human wastes.



To repair Jumping Run Creek, Doll teamed up with N.C. Cooperative Extension Service researchers who have monitored the creek's watershed for the last year to determine the source of bacteria and how it reaches the creek. High concentrations of fecal coliform bacteria are found in ditches that drain into Jumping Run Creek from the surrounding woods, roadways and residential communities. The research team will design the repairs using Cooperative Extension's monitoring information.

Doll says this project will improve water quality in Bogue Sound shellfish waters through biological and engineered stormwater controls and education programs for local municipal leaders and residents. These strategies will be evaluated in 2000, and they will serve as models for reducing bacterial contamination in other coastal shellfish waters.

— J.F.N.

Big Fish Bring in Big Money

Bluefin tuna are big fish with even bigger moneymaking potential for the Hatteras area.

A report on the economic impact of this fishery found that over a 51-day period in 1997, bluefin tuna anglers spent more than $3.8 million in Hatteras and elsewhere in North Carolina. Before 1996, the fishery did not exist.

This study of the winter recreational Atlantic bluefin tuna fishery in Hatteras was designed to learn more about the fishery and its participants. The relatively new fishery developed after large bluefin tuna were discovered near the shipwrecks off Hatteras. Until this study, little was known about the fishery participants, their catch and harvest practices, and their economic impacts on the local community and North Carolina.

The study requested names and addresses from bluefin tuna anglers at the end of their daily fishing trips. Among them, 1,051 were mailed a questionnaire about their trip, and 65.1 percent responded.

To order a copy of the report, ***A Social and Economic Study of the Winter Recreational Atlantic Bluefin Tuna Fishery in Hatteras,*** N.C., send a $12 check payable to the Texas Agricultural Experiment Station to Robert B. Ditton, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77840-2258. The $12 covers the cost of the publication, postage and handling.

—J.F.N.

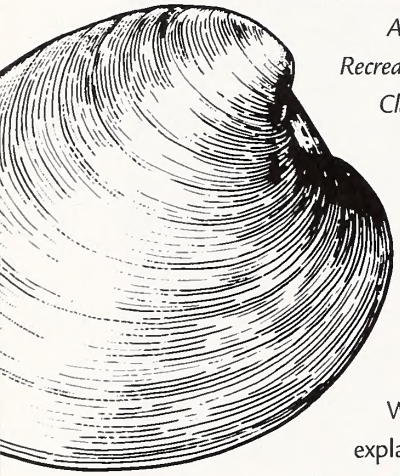
In the Next Issue of *Coastwatch*

Surf fishing at Cape Hatteras is world famous, and in the fall, it's a frenzied rite of sport and culture that has few peers on the coast. In the next issue, T. Edward Nickens hangs out at "the Point" for a frontline accounting of surf-fishing history and hysteria. Wader-up and join him in the third installment of his series about coastal landmarks.

COASTAL
TIDINGS

Clamming Around

If you've ever seen someone shuffling along the beach, toting a bucket and bending over every few feet to poke at the sand with a clawlike tool, then you've probably witnessed clamming. If you've ever wondered how to do it yourself, then a new Sea Grant publication will give you the instruction you need.



A Guide to Recreational Clamming: Keyholing, by Sea Grant marine extension agent Wayne Wescott, explains several clamming techniques: finding exposed clams, scanning for spitting sign, raking and using touch. Wescott focuses on keyholing, searching the sand for the uniquely configured holes left by clams as they filter water.

As a bonus, recipes for enjoying the harvest are included: Down East Clam Chowder, Manhattan Style Clam Chowder, New England Clam Chowder, Deviled Clams and Clamburgers.

To order a copy, send a check for $2.50 to North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. Ask for publication UNC-SG-98-01.

If you'd like to chat with Wescott about clamming, call him in Nags Head at 252/441-3663. ◘ —*D.D.*

Sea Oats Anchor Renourished Dunes

Dunes along Wrightsville Beach's popular waterfront strand are now anchored with 25,000 sea oats planted through an innovative partnership between the town and a Florida grower.

Wrightsville Beach allowed an out-of-state grower to harvest seeds from homegrown sea oats. In exchange, the grower returned plants raised from the seeds. Volunteers — recruited and trained by Spencer Rogers, North Carolina Sea Grant's coastal erosion and construction specialist — planted the sea oats along about a mile of shoreline in June.

The plants were placed on a renourished section of beach that had been consumed by Hurricane Fran in 1996. Dredged sand was pumped onto the beach to make up for future erosion, and the sea oats were planted to help stabilize the new dunes and to trap sand.

Sand dunes are a beautiful sight on North Carolina beaches, but they also have a practical purpose for waterfront landowners because they can protect buildings from storm surges. During a storm, the ocean has to scour away the dunes before reaching the foundations of nearby homes.

"Dunes can save buildings during storms," Rogers says. "Sand buys time. It's the sand that really provides protection. Dune grasses trap sand and keep it from blowing away."

Waves whipped up by Hurricane Fran destroyed about 500 homes both north and south of the beach renourishment projects at Carolina and Wrightsville beaches, Rogers says. By comparison, the homes within those projects, where man-made dunes were in place, suffered no foundation failures.

The sea oats-harvesting project — coordinated by Gregory Walker, director of Cape Fear Resource Conservation and Development Inc. — allowed the Florida grower to collect seed at Topsail Island and Wrightsville Beach and to market the plants in North Carolina. The North Carolina State University Cooperative Extension Service is also working with farmers to grow sea oats regionally.

North Carolinians currently plant more American beachgrass on dunes than sea oats because it's much cheaper — but it's not native to the state. Sea oats are. ◘

—*J.F.N.*

BIG SWEEP '98

Mark your calendar for Sept. 19 and join other volunteers for the First Citizens Bank Big Sweep as they collect litter from the state's waterways and coast. Last year, volunteers retrieved 252 tons of debris along North Carolina's waterways. This year, organizers hope to schedule cleanups in each of the state's 100 counties, says executive director Judy Bolin. For information, call 1-800/27-SWEEP. ◘

Catch & Release

If you aren't a fan of fishing tournaments, you may believe that a fish caught in one of these contests is going to end up dead. That's not necessarily so. As freshwater bass tournaments have proven, catch-and-release formats can be satisfying for fishers and successful for sponsors. Now Jim Bahen, a Sea Grant marine extension agent in Wilmington, would like to see more organizers of saltwater fishing events move away from "kill tournaments" and give catch and release a try.

Bahen is concerned because kill tournaments require participants to bring in fish over a minimum size so that the biggest fish are caught and killed. In many species, such as billfish and king mackerel, the largest fish are the females, the breeding stock. By removing these individuals from the population, the breeding potential is reduced. In the long term, this could hurt the species — and fishing.

Some saltwater tournaments already incorporate catch-and-release approaches. According to Bahen, tournament operators have four options:

- Official observers ride with fishers on their boats and count the number of fish caught and released.
- Fishers put fish in a well onboard and keep them alive until the boat returns to the dock. There, officials measure both the biggest fish caught and the total weight of all fish caught. After weighing, the fish are set free.
- Fishers carry disposable cameras on the boat and hook, tag, photograph and release fish. At the end of the day, officials develop the film and record the number of fish tagged.
- In surf fishing tournaments, fishers bring their catch alive to a weigh-in station and then set the fish free.

Bahen stresses that catch-and-release tournaments are attractive to fishers in two ways: They can participate with a competitive spirit, and they can feel good about preserving a resource.

"We're working on the old attitude of 'catch all I can today and don't worry about tomorrow,'" Bahen says. "We want to leave the fish biting at the end of the day — that leaves me feeling satisfied."

If you would like to talk about catch-and-release techniques, contact Bahen at 910/256-2083, ext. 212. ◘

— D.D.

A Meal Fit for a Crab?

What pleases the palate of a blue crab? Researchers hope the answer to that question will help crabbers and poultry producers alike.

In a recent study by North Carolina Sea Grant and NC State University's poultry science department, crabs were about as likely to choose an experimental bait made of fermented poultry as they were to select the usual menhaden bait.

That finding could be significant on two fronts, says Sea Grant marine extension agent Bob Hines. Crabbers have few sources of traditional bait, and the price of menhaden has risen 55 percent in the last three years. At the same time, poultry producers face an increasing challenge in disposing of dead birds. A flock of 10,000 turkeys, for instance, may account for 4.6 tons of carcasses in an 18-week cycle.

The experimental bait will be studied more fully in a Sea Grant-funded project. ◘

— D.S.B.

First Aid First

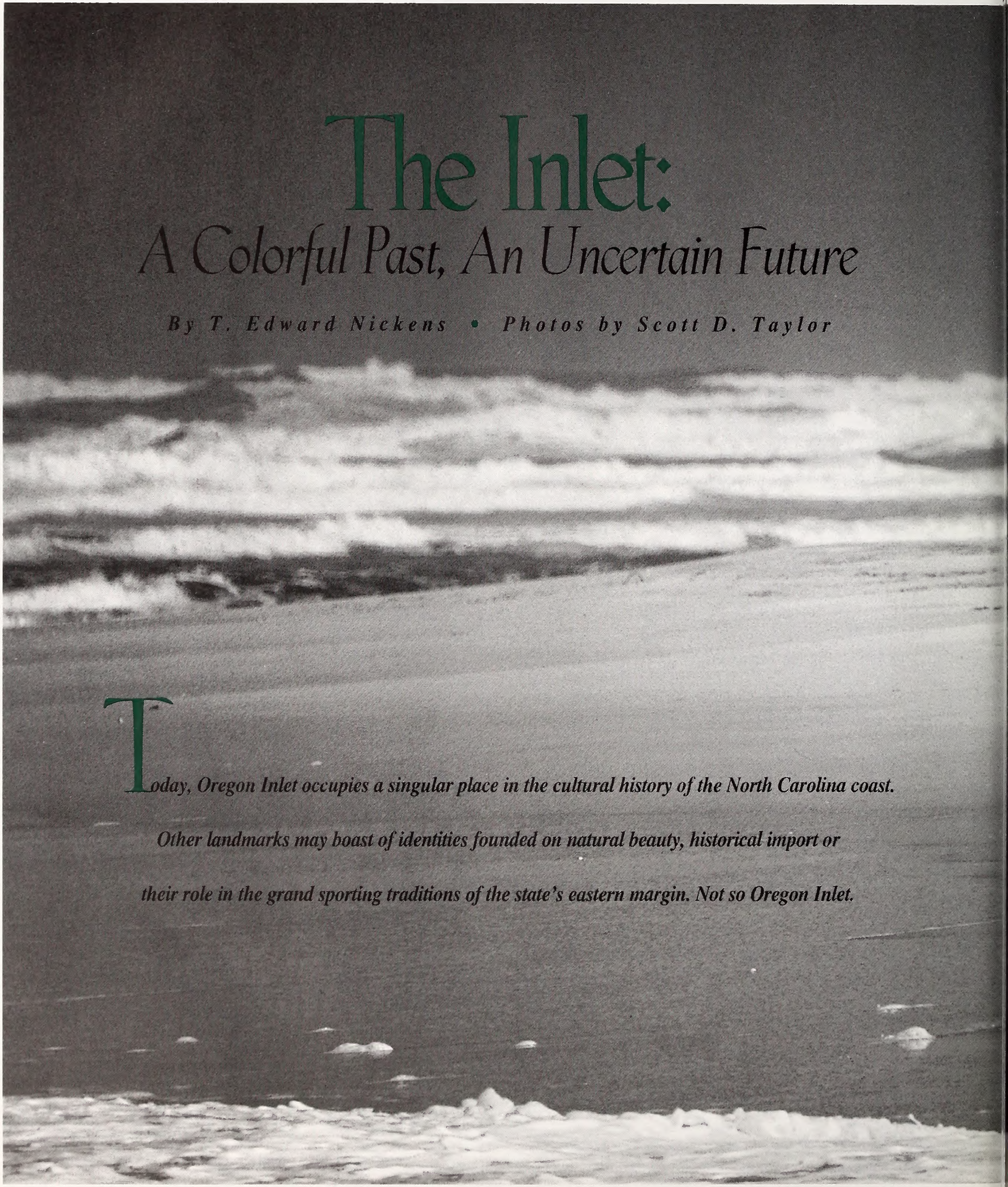
Usually, a bad sunburn is the worst experience you have at the beach or on a boat. But be aware of other dangers. You or your companions may be injured, suffer heatstroke or be stung by a marine organism.

The key is to be prepared. Pack a clearly marked first-aid kit sturdy enough to withstand the salty environment. Essential items include:

- adhesive bandages
- an athletic bandage
- first-aid adhesive tape
- a vinegar solution or isopropyl alcohol
- meat tenderizer to apply in a paste on jellyfish stings
- hydrogen peroxide
- pain relievers
- antihistamines
- a first-aid manual.

Do not move an injured person unless absolutely necessary. And if you're aboard a boat during an emergency, contact the U.S. Coast Guard on channel 16 (VHF) or 2182 kHz (HF). ◘

— D.S.B.

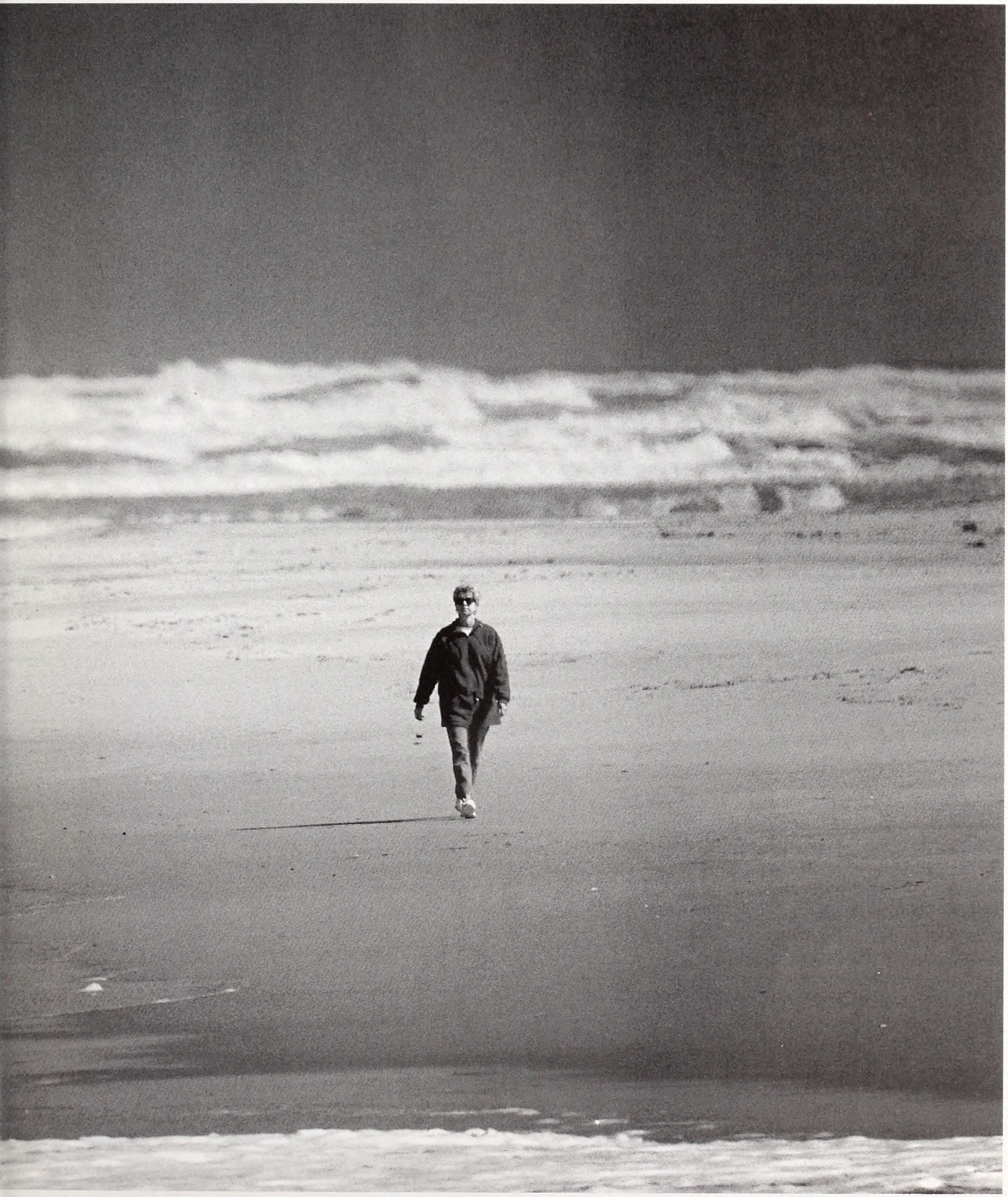


The Inlet:

A Colorful Past, An Uncertain Future

By T. Edward Nickens • Photos by Scott D. Taylor

Today, Oregon Inlet occupies a singular place in the cultural history of the North Carolina coast. Other landmarks may boast of identities founded on natural beauty, historical import or their role in the grand sporting traditions of the state's eastern margin. Not so Oregon Inlet.



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Sometime during the mid-morning hours of Sept. 8, 1846, a man we know only as Mr. Midgett of Bodie Island sat astride his horse on the northern Outer Banks. For several days, a heavy northeast blow had scoured the barrier islands and pushed water into the northwest reach of Pamlico Sound, but for the moment the storm had abated, the winds had calmed, and Midgett had wandered into the dunes. He was three-quarters of a mile from his house when a sudden squall hit from the southwest, and the soundside waters, pent up like raw emotion, roared seaward across the narrow sand banks. The entire island was inundated; only the tops of the dunes were exposed. Trapped atop one of them, caught in the full fury of the storm, was Midgett and his mount.

These are slow days at the Wanchese harbor, where commercial fishing boats rely on safe passage through Oregon Inlet's difficult waters.

I read this story in the quiet chambers of the Outer Banks History Center in Manteo, the yellowed pages of the old U.S. Coast Survey report crinkling like the sound of coquina shells clattering in surf. I imagine Midgett huddled out there on the dunes, gripping a wet saddle pommel, leaning into the lee of wind behind his horse's salty mane. Midgett "sat upon his horse on a small sand knoll for five hours," according to the report, "and witnessed the destruction of his property, and (as he then supposed) of his family also, without the power to move a foot to their rescue, and, for two hours, expecting every moment to be swept to sea himself."

When the waters receded, Midgett saw that his world had been dramatically altered. The storm carved two new inlets in Bodie Island — one that would soon disappear, but another that yet remains. Sometime in the months after Midgett's stormy vigil, a ship successfully passed through one of those inlets. That vessel would long be remembered, though her name would cause Outer Banks travelers a century later to scratch their heads in confusion. She was a side-wheeler steamboat on her maiden voyage to Carolina. Her name was *Oregon*.

Today, Oregon Inlet occupies a singular place in the cultural history of the North Carolina coast. Other landmarks may boast of identities founded on natural beauty, historical import or their role in the grand sporting traditions of the state's eastern margin. Not so Oregon Inlet. Certainly natural beauty and the sweep of history have a say in the story of this 2,500-foot cleft in the barrier island chain, but their voices are drowned by the great hue and cry that has come to define the inlet: the 30-year-old proposal to anchor the shifting inlet with two massive stone jetties built by the U.S. Army Corps of Engineers. The jetties would extend into the open ocean nearly two-thirds of a mile and cost between $80 million and $120 million to build and up to $500 million more to maintain for the next 50 years. Authorized by Congress in 1970 but never fully funded, the twin breakwaters, supporters say, would stabilize the inlet and allow for a deeper channel, which would make passage safer and attract larger fishing boats to North Carolina ports. Jetty backers maintain that the structures would help stymie erosion at Bonner Bridge and along nearby N.C. 12, "the lifeline of the Outer Banks," according to Outer Banks Chamber of Commerce president John Bone. Commercial fishers, marina and motel owners, the Department of Transportation and politicians from Gov. Jim Hunt to U.S. Sen. Jesse Helms to Dare County's State Sen. Marc Basnight have queued up to lend unflagging support to the jetty effort.

But the plan is controversial. Coastal geologists question the Corps' assessments of its ability to manage the moving inlet shoreline. Taxpayer groups decry the project as pork-barrel spending with costs that outweigh benefits. Environmentalists contend that the jetties would increase erosion on the adjacent Pea Island National Wildlife Refuge and might prevent juvenile fish from finding their way into the protected nursery areas of Pamlico and Albemarle sounds.

When I visit, I find few folks to speak of the Oregon Inlet that existed in the era before Bonner Bridge went up in 1963. Nearly forgotten are the old Confederate fort, the two lighthouses and one historic lifesaving station long since lost to the inlet's migration, the ferry service started in 1924 by a local fisher and the shuttles the state ran in the 1950s with converted U.S. Navy landing craft. Mention Oregon Inlet today, and there is little talk of its storied past. Instead, the subject inevitably leads to a single conundrum: What can we, what should we, what will we do with Oregon Inlet?

Located nine miles south of Whalebone Junction, where U.S. 64 transects the Outer Banks, Oregon Inlet is today the only inlet between Cape Henry, Va., and North Carolina's Hatteras Inlet, 130 miles down the shore. Safe passage through Oregon Inlet is critical to a commercial and recreational fishing fleet, but it has long been known as one of the most violent inlets on the East Coast — one newspaper writer tagged the inlet "the undertaker" of the Graveyard of the Atlantic — and its shifting shoals have been blamed for at least 21 deaths since 1963.

But far more than fish dinners come through Oregon Inlet. Relying on the inlet are boats from as far away as Edenton and Elizabeth City, Kitty Hawk and Duck, Columbia, the Alligator River area and Engelhard on the Pamlico shore. Oregon Inlet is the closest door to the open ocean for yachters; recreational fishers in charter boats and personal sportfishing boats; commercial fishers in netters, trawlers and longline vessels; and folks out for a pretty day's ride in a skiff. And safe passage over Oregon Inlet via the high-rise bridge is the primary access to Cape Hatteras National Seashore. Each year nearly 175,000 vehicles cross Bonner Bridge, and the money spent at campgrounds, restaurants and rental property on the Outer Banks helps keep local families afloat through the deserted winters and put kids from Avon and Buxton through college.

Yet few since Midgett have understood so clearly the volatile nature of this channel. Like all its kin, Oregon Inlet changes shape and position as wind, tide and storm eternally sculpt the barrier islands. Just after Midgett's miserable day, the inlet was less than 60 feet wide, but four months later it had widened to 321 feet at low tide, and by 1909 the inlet had expanded to 2,500 feet, approximating its current size. And it has consistently migrated south. As ocean currents move down the beach, they carry sand, transporting sediments in a general north-to-south direction. The northern side of Oregon Inlet migrates southward, while the southern side retreats. Today the inlet lies two miles from its original location, and its southward movement continues.

For most of Oregon Inlet's existence, its vicissitudes were of minor concern, but a new era began in the 1950s when the Corps of

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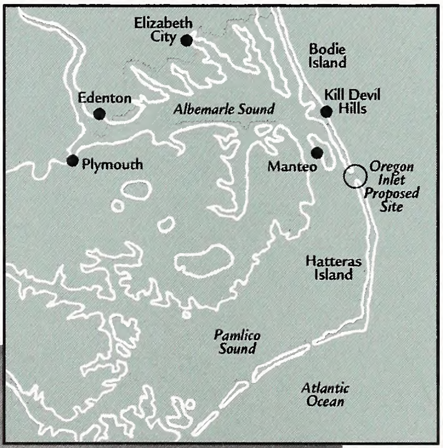
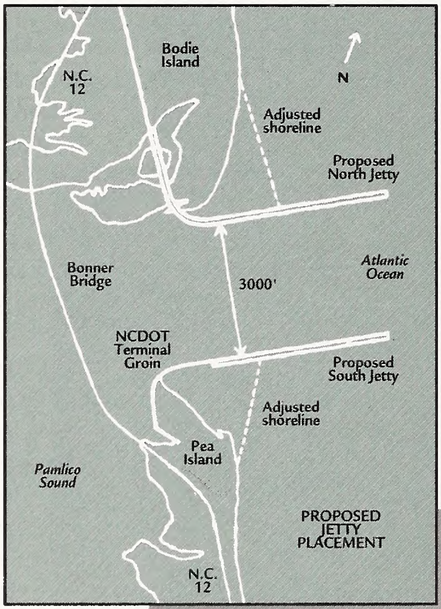


Shoaling waters forced the U.S. Coast Guard to abandon this historic station, now marooned on a sandy plain.

Engineers started dredging to allow larger trawlers to safely pass and in 1963 when the two-and-a-half-mile-long Bonner Bridge was built. The inlet's natural inclination to migrate south began to threaten bridge foundations, and the shifting inlet channel required greater, and more expensive, measures to maintain its place. The Corps of Engineers now keeps one dredge boat working in Oregon Inlet full-time and occasionally calls for backup vessels. The dredging program costs about $5 million a year, but still the Corps can keep open only a 14-foot channel through the inlet about 30 percent of the time. Fishers contend the inlet's shoaling costs lives, jobs and earnings, and few deny that the critical Bonner Bridge is at risk. But coastal scientists and environmentalists question whether any man-made solution can blunt the forces of a dynamic barrier system, and land managers with the U.S. Department of the Interior have refused to allow jetties to be anchored on their property.

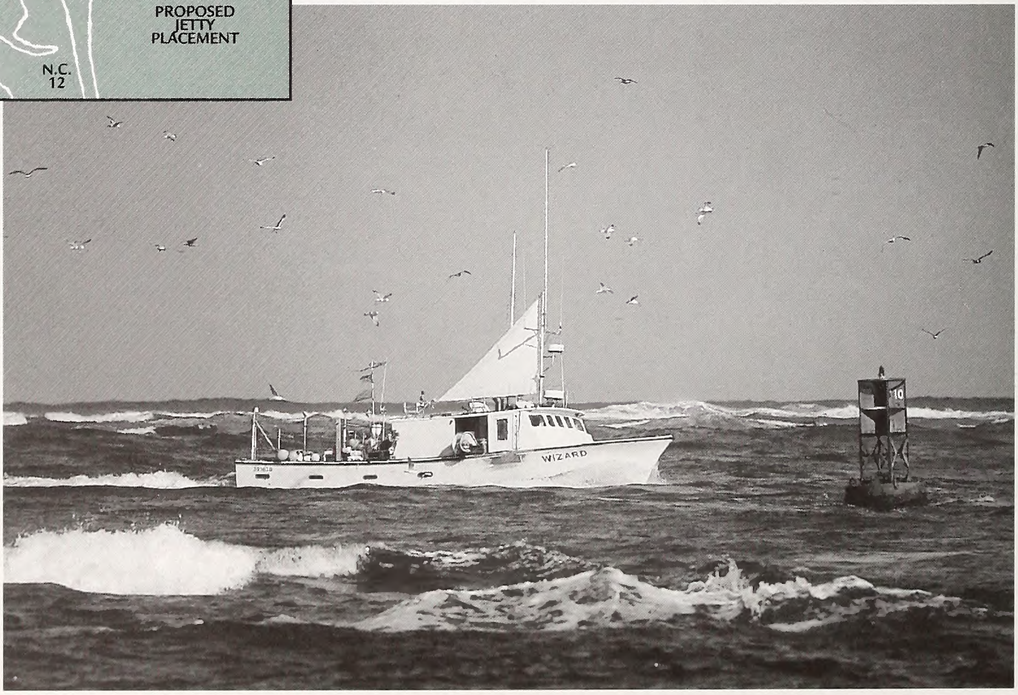


So what to do? I ask myself that question as I drive from Whalebone Junction down Bodie Island and across Oregon Inlet to the Pea Island National Wildlife Refuge, where the Corps proposes to construct the southern jetty. I've spent many a happy hour at Pea Island, scanning the marsh ponds for wading birds and hoping to glimpse a peregrine falcon. I've lolled about the deck of a charter fishing boat while it crossed the ocean bar at Oregon Inlet, celebrating a catch of dolphin fish with friends while the tight-lipped boat captain worried about keeping the hull out of the sand.

I've fished at Hatteras point and camped at Ocracoke and eaten more than my fair share of fresh tuna. I'm no commercial fisher or Hatteras Village cottage owner, but the decisions made at Oregon Inlet will matter to me. Six hundred million dollars is serious money to spend on stabilizing an inlet through a changing barrier island. What are our choices?

I am unsure Tom Jarrett can tell me, but fate has tapped him for the job of point man for the Oregon Inlet jetty project, and he agrees to meet me — one more writer, the 50th, the 100th? — at the inlet that has consumed his career. Jarrett is chief of the coastal, hydrology and hydraulics section of the Corps' Wilmington District. So far, the Department of the Interior has refused to allow jetties to be constructed on its land, citing concerns over eroding Pea Island's critical shorebird and waterfowl habitat. At present, construction awaits another round of public review, this one in response to a fresh economic analysis and the Corps' latest plan to move trapped sand with ocean dredges and spread it along Pea Island whenever needed.

Another 90-day comment period will follow, this one likely open through early autumn, then the Corps staff will have another chance to take a deep breath while state and federal officials wrangle over whether to try to land



Coming home means crossing the ocean bar at Oregon Inlet.
In rough water, it's a tough place to be.

Caught in the middle and taking the heat of the 30-year jetty fight are Corps engineers Bill Dennis (left) and Tom Jarrett.

money from Congress. Who would relish that fight? No wonder I expect in Jarrett a gruff character with a hardened heart and an unequivocal disposition toward journalists. He waits in a white sedan with state plates, chatting with Bill Dennis, the Corps' project engineer for the jetties. Jarrett wears a white hat emblazoned with the Corps logo and reminds me a bit of novelist Tom Clancy. Through 30 years of bickering, he has remained a lighthearted fellow, quiet and fond of a crook-stemmed pipe. He is quite open about the controversy that has occupied so much of his time and energy. When Dennis jokes that "some people have pictures of their grandkids in their wallet, but Tom's got pictures of Oregon Inlet in his," Jarrett grins at the jab.

Jarrett leads the way up a few sofa-sized boulders as we gingerly climb a rock groin built to protect the southern foundations of Bonner Bridge. Mergansers paddle in the calm waters as Jarrett explains how the jetties would work. Two ridges of rock would extend into the ocean some 3,500 feet — their original length shortened by 1,000 feet to reduce environmental impacts — and anchor to the mainland with a submerged tail of stone thousands of feet longer. Jetties trap sand that would normally drift down with the littoral currents, replenishing distant beaches, so the Corps designed a sand-bypassing mechanism to stem erosion south of the jetties. At Oregon Inlet, shoreline currents would deposit sediments in a basin on the south side of a low section of jetty, a weir built like a notch in the rock wall. Each year, ocean pipeline dredges with 10,000-horsepower pumps would suck up an estimated 862,000 cubic yards of trapped sand and move it across the inlet, where it would be distributed as needed to the downshore beaches. This sand-bypassing mechanism would spread accumulated sediments during the fall, after the sea turtle nesting season. The jetty structure itself would have three layers of stone: a foundation of rock 1 to 18 inches in diameter; a middle layer of stones weighing from 100 pounds to 1 ton; and the final sheathing of armor stone, each rock weighing up to 30 tons — think of a boulder about 8 feet through the middle. All told, 1.2 million tons of rock designed to blunt the sea's waves.

And help stem the inlet's southward march. This migration is dangerously narrowing the navigation channel, chiefly because in 1989-90 the state of North Carolina built the huge stone groin that encloses the northern end of Pea Island like a rocky parenthesis. Now that boundary of Oregon Inlet is locked into place, and the shore of Bodie Island creeps ever closer. When the state built that groin, it drew a line in the sand. The possibility of variability "has effectively been eliminated," Jarrett says. "You have fixed where the channel is going to be." In some respects, perhaps, that variability was eliminated with the construction of Bonner Bridge or even N.C. 12. But what are you going to do now, Jarrett asks. Let the bridge fall in the water? Pull up the road?

He knows what he is going to do: wait for yet another round of public review. "The Corps does what it is directed to do," he says. "And the reason we've been at this for so long is that local officials have been very effective at keeping the project alive. This latest round of review could be the final answer, but we've been here before. The Department of Interior simply doesn't want the jetties on their land. They've made it clear that nothing can be done to make the jetties acceptable, period. They liken them to putting a McDonald's beside Old Faithful. And that's something that goes beyond science."

But according to the jetties' most

Continued

vocal opponents, science alone suggests that the prudent action is to shelve the plan. Coastal geologists have consistently questioned whether the Corps could prevent erosion on Pea Island and Cape Hatteras National Seashore — although the latest sand-bypassing plan is currently under scrutiny — and ask why the jetties are necessary to begin with. Commercial and recreational vessels already ply Oregon Inlet regularly. Scientists such as Stanley Riggs at East Carolina University, Duke University's Orrin Pilkey and a constellation of others argue that the Corps' plan does not give enough consideration to factors such as barrier island migration or the possibility of increased sea level rise in response to potential global warming.

Wanchese patriarch Capt. Will Etheridge Jr. says the fishing industry is looking for a helping hand, not a handout.

Not long after meeting Jarrett on the Pea Island groin, I attend a lecture by Riggs in the public aquarium on Roanoke Island. According to Riggs, the inlet history of the Outer Banks has much to say about the future of these islands. An inlet at or near the present site of Oregon Inlet appeared as "Port Ferdinando" on a 1585 map of the region and was called "Gun" or "Gunt" inlet by later cartographers. It closed sometime before 1798 and remained plugged with sand until the 1846 hurricane and Midgett's hard day in the dunes. Just look at what has happened with inlets along the northern Outer Banks, Riggs says, and it's easy to tell that the only thing constant about this coastline is change. From 1585 to 1600 along the stretch of beach from Cape Henry to Cape Hatteras, six inlets were open at one time or another. From 1600 to 1800, five. In the 19th century, there were three. From 1900 to 1945, two. And from 1945 to the present, only Oregon Inlet. "With rising sea level," Riggs says, "we have moving sands, and those sands are closing inlets." Coastal geologists insist that Oregon Inlet is in no imminent danger of closing, with or without stabilization. But attempts to lock it into place will come at a great cost to distant generations and to the current one.

Six hundred million dollars (give or take) will dent future federal and state budgets, but plenty of Outer Bankers will say that Oregon Inlet's current status exacts a price from them every day. The commercial fishing industry in Dare County is struggling, and its viability largely depends upon a reliable Oregon Inlet. Capt. Will Etheridge has become a spokesperson for Outer Banks watermen — he is president of the Oregon Inlet Users Association, a group that has long lobbied for construction of the jetties — and he meets me on a shopworn fishers' dock on the Wanchese waterfront.

The Wanchese fishing industry stands to benefit greatly from a jettied Oregon Inlet. In the late 1970s, banking on the eventual construction of the rock breakwaters, more than $10 million in state and federal funds was poured into the construction of a Wanchese seafood processing facility that could handle the larger commercial trawlers a stabilized inlet would attract. But without the jetties, the Wanchese Seafood Industrial Park has few fish to process.

We motor around the docks in Etheridge's workboat, watching a man in orange coveralls hose down the decks of the trawler *Capt. Ralph.* Longline mackerel and tuna boats line up at the dock, and power tools whine from a bustling little boatyard where gleaming white sportfishing boats are corralled, but Etheridge insists the seafood park is on the skids. "We had a ship lift here that went broke ... . Used to have plenty of boats," he says. "No more." In recent years, trawlers operating out of Wanchese might lose 10 or 15 working days each season due to conditions in Oregon Inlet, he says. "That restricts your working time," he adds morosely. "Cuts your production."

With jetties, the Corps plans to

keep a 20-foot channel dredged through Oregon Inlet, and that should attract larger trawlers to the Wanchese docks. But that's only part of the jetties' benefits, according to Etheridge. Build the jetties, and fishers who use Oregon Inlet might not have to pay higher insurance rates than other boat owners. Build the jetties, and fewer people will die. "I've picked up bodies," Etheridge says, "and signed affidavits for bodies that were never recovered."

No doubt a stabilized inlet would make passage safer for fishers. No doubt it would increase opportunities to land fish in North Carolina rather than Virginia, a benefit to watermen, seafood processors and the Wanchese Seafood Industrial Park. But beyond that, the doubts remain, driven by charge and countercharge, study and analysis and findings from all quarters. Even the most neutral observers are exasperated with the process.

As I leave the Outer Banks, I drive north over Bonner Bridge, craning my neck to peer past the guardrails at the swells breaking over the inlet's oceanside shoals. From the top of the bridge, I see the sandy plain of Bodie Island's growing spit stretching far into the distance, then necking down to the narrow hourglass constriction directly under the bridge. Down there is an Oregon Inlet perspective I haven't yet experienced, so I pull onto the sand road just up Hatteras Island from the bridge and head south again toward the inlet.

Driving alone on the beach always makes me nervous, and my jitters aren't eased by the painted sign warning of its impassability at high tide. I drive past the vegetated dunes and onto the barren sand of the accreting flats, then to the very edge of the spit at the foot of the towering Bonner Bridge. It is a calm day by Oregon Inlet standards, but wind-driven sand still sifts across the flats, distorting the shapes of distant beach-combers like heat shimmer in a desert.

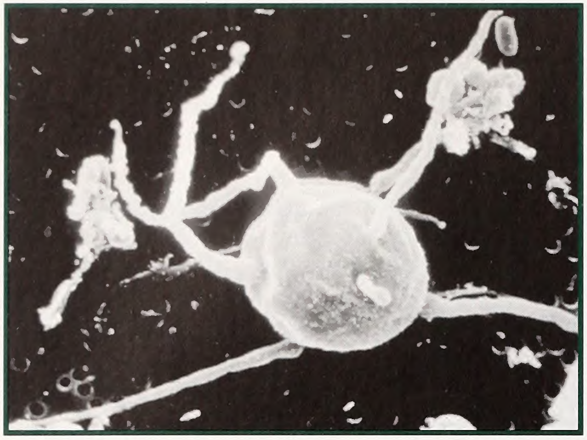
Gulls hover in the wind, diving to pick up pieces of fish battered on the shoals and trapped in the shallow water. I can see the corroded metal gallows of the *Lois Joyce*, sunk in December 1982 and now just a few stones' throws from the moving shore. Across the inlet is Pea Island and the gray smudge of the groin like a smear of smoke on the water. That's where the line has been drawn, I think, and not with a finger in the sand but with boulders 9 tons heavy.

These are the two telling perspectives of Oregon Inlet. One the wild shore, shifting, shaping and reshaping like a living entity, breathing for all the embayed waters behind it. And the other the rocky emblem of man's efforts to control that malleability. On this day, just a thousand yards separate them, and the gap is closing.

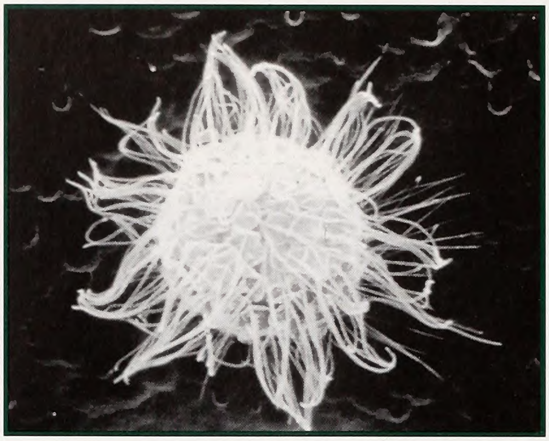
Somewhere I've read that in past times inlets weren't even named unless they were a year old. Who could tell when nature would conspire to close them? I remember Etheridge saying that he could recall days as a boy when there was but 3 feet of water in Oregon Inlet. Some days you could cross to fish the outside waters, and some days you couldn't. The natural way of things. And I remember the resignation in his voice as I leave the Wanchese docks. "We're trying to satisfy everybody," he says, "and you know that ain't gonna work." Which is one way of saying that all interests regarding Oregon Inlet are caught between a million tons of rock and a hard place.

And one more time I think of Midgett, who watched the wind and water transform his world. He couldn't comprehend such a thing as a mile-long jetty. Computer modeling of hydrological forces and cost-benefit analyses would be utterly lost on the man who witnessed the birth of Oregon Inlet. But he would know the raw face and the unleashed force of nature, and I wonder what he would think of it all. ◘

The growing sand flats on Bodie Island lie under the soaring Bonner Bridge, which is itself threatened by the shifting channel.


Karen Steidinger and Howard Glasgow

Pfiesteria *has 24 life stages ... including star ameoba*


Nature, 1992

... cyst from toxic zoospore

Courtesy of JoAnn Burkholder Laboratory

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Beyond *Pfiesteria*: Harmful Algae in Coastal Waters

By Jeannie Faris Norris

It's been called the "cell from hell" and compared — absurdly — to the deadly *Ebola* virus. *Pfiesteria piscicida* has been given horror movie proportions by some accounts.

But *Pfiesteria* is not a freak of nature, nor is it a monster. It has not killed people, and its threat to human health has yet to be proven. Rather, *Pfiesteria* is a harmful algal bloom (HAB), one of many that plague coastal waters around the country.

"HABs in general are a problem that I think we should be paying a lot more attention to," says JoAnn Burkholder, a North Carolina Sea Grant researcher and codiscoverer of *Pfiesteria piscicida*. "*Pfiesteria* is a recent poster child, and it's only one of many that are really important in coastal areas and are causing a lot of havoc."

Virtually invisible, small numbers of HABs such as *Pfiesteria* may live in coastal waters at any time. But in the right environment, they can form large colonies or blooms that discolor water and deplete oxygen that other marine organisms need to survive. HABs also can cause human illness and death, alter marine habitats through shading and overgrowth, and close coastal businesses.

The recent spate of headlines might suggest otherwise, but harmful algae are nothing new. They have been around for thousands of years, says Barbara Doll, North Carolina Sea Grant's water quality specialist. The Old Testament of the Bible contains the first known description of a red tide, and Native Americans in the Pacific Northwest were aware of shellfish poisonings centuries ago.

Courtesy of JoAnn Burkholder Laboratory

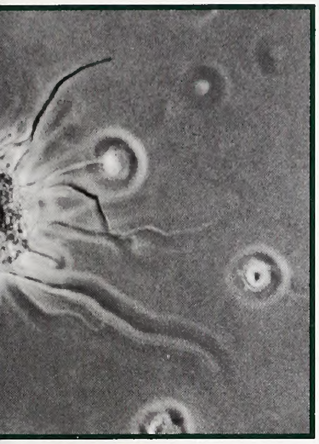
The toxic stages of Pfiesteria *have been linked to sores and fish kills, particularly among menhaden.*

But in recent decades, the United States has experienced an escalating trend in harmful algal blooms such as *Pfiesteria*, says Don Anderson, a scientist for Woods Hole Oceanographic Institution Sea Grant and one of the world's leading experts on HABs.

Before the early 1970s, only a few regions of the United States suffered outbreaks of toxic algae. Now, virtually every coastal state is threatened by at least one toxic species that can be found over large areas. Among many others, they include red tides in the Gulf of Mexico and along the southeastern coast; brown tides off New York and Texas; and dangerous, even deadly, shellfish poisoning off Maine, the Pacific Northwest and Alaska.

"This is a much, much bigger problem than *Pfiesteria*," says Anderson, who leads one of the nation's premier research labs addressing HABs. "There are similar organisms elsewhere in the country."

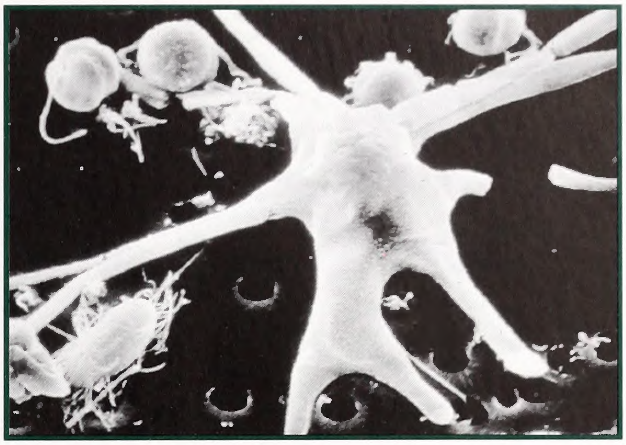
Nationally, the losses to coastal resources and communities may exceed



JoAnn Burkholder and Howard Glasgow

... toxic zoospore

JoAnn Burkholder and Howard Glasgow



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$1 billion, according to the National Oceanic and Atmospheric Administration's Coastal Ocean Program.

In North Carolina, the 1987 red tide that closed shellfishing along more than 250 miles of shoreline during peak harvest season caused $25 million in losses to the seafood and tourism industries, Doll says. And nationally, the fishing industry alone loses $35 million to $65 million per year to outbreaks of red tide, brown tide, oxygen-depriving algae blooms and toxic algae such as *Pfiesteria*, says Sen. Olympia Snowe, R-Maine, chair of the Senate Commerce subcommittee on science and fisheries.

"Even more troubling is that science cannot fully explain why this is happening or how to prevent it in the future," Snowe says.

With losses of this size threatening the country's coastlines, scientists are searching for the causes of the increase and spread of HABs.

Some evidence points to widespread eutrophication, which is caused by excess nutrients such as nitrogen and phosphorus that filter from wastewater treatment plants, cropland, livestock facilities and urban runoff. The nutrients stimulate the growth of algae and aquatic plants and may contribute to the proliferation of HABs.

Climate change may be another culprit, causing shifts in sea surface temperature and elevation that may create more suitable environments for harmful algae.

Finally, some researchers suspect that heightened awareness and better reporting may be partly responsible for the observed increases in HABs.

Pfiesteria — Perplexing Fish Killer

If ever a harmful algal bloom had a Jekyll-and-Hyde personality, it is *Pfiesteria piscicida*.

From a harmless cyst that lies in the sediment, this organism can transform itself into a toxic dinoflagellate that kills fish. JoAnn Burkholder, a North Carolina Sea Grant researcher who codiscovered *Pfiesteria*, says she believes it becomes toxic when it detects something that the fish excrete or secrete, but she has yet to identify the substance.

"We're working very, very hard to determine what it is in fish excreta or secreta that stimulates *Pfiesteria* to this Jekyll-and-Hyde transformation," Burkholder says. "We don't know the substance."

Benign most of the time, the organism is toxic in four of its 24 life stages. Exposure to active *Pfiesteria* cultures in the laboratory kills healthy scallops and striped bass in minutes. At chronic, sublethal levels, its toxins create bleeding lesions and destroy the epidermis of finfish and the carapace of blue crabs. It can also depress fishes' white blood cell counts to 20 percent of normal.

Human health effects – including cognitive impairment, memory loss, nausea and asthmalike distress – have been linked to *Pfiesteria* exposure in the laboratory. The effects on people who work on waters affected by fish kills are being studied.

The cellular features of *Pfiesteria*-like organisms suggest they are among the oldest living dinoflagellate species, Burkholder says. *Pfiesteria* was first reported in *Nature* in 1992, and it has since been linked to major fish kills affecting millions of fish in North Carolina's estuarine waters, according to N.C. Division of Water Quality figures.

These organisms thrive in poorly flushed estuaries with water degraded by human sewage, animal wastes and other forms of nutrient overenrichment, Burkholder says. But large fish kills can result from a variety of causes – *Pfiesteria* is one, low dissolved oxygen is another – and they often cannot be attributed to a single cause.

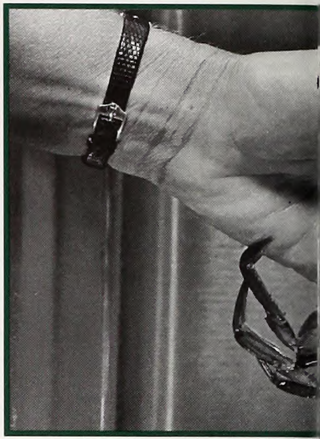
—J.F.N.

Courtesy of Hans Paerl

Mike Piehler (left) and Jay Pinckney, postdoctoral research scientists, test water quality at the Institute of Marine Sciences (IMS) experimental pond.

Courtesy of JoAnn Burkholder Laboratory

Pfiesteria *research is conducted at JoAnn Burkholder's toxic containment culture unit.*



David Griffith surveyed crabbers who work

Pfiesteria Research:
Scientists Study Causes & Effects

By Jeannie Faris Norris

The hot, still days of summer have arrived. Vacationers may flock to our beaches for sun and surf, but just a few miles inland, conditions in our brackish waters are ripening for fish kills and *Pfiesteria piscicida.*

Pfiesteria made national news last year when it was discovered in tributaries of the Chesapeake Bay, killing thousands of fish and forcing closure of two rivers. Large kills in North Carolina in 1991 and 1995 also corresponded to the organism's presence.

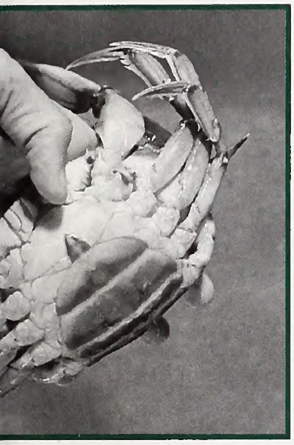
Considerable hype and attention have since been focused on *Pfiesteria*, but we still don't know precisely what causes these kills and what impact they have on human health and seafood. The process of scientific discovery can be slow. But we're a few steps closer to the answers thanks to recent reports from four teams of scientists assembled by North Carolina Sea Grant. In 18-month studies, these teams examined how *Pfiesteria* affects the health of crabbers in fish-kill areas, the learning ability in laboratory rats and the quality of seafood taken from kill waters. A fourth team examined how the nutrients that seep and spill into state waterways affect one of *Pfiesteria*'s nontoxic life stages.

Courtesy of JoAnn Burkholder Laboratory

Large fish kills have heightened public concern about Pfiesteria *and water quality.*

Some facts are already known. *Pfiesteria*-like organisms have been found in coastal waters from Delaware Bay to the Gulf of Mexico. Recent research suggests there are as many as four species. The complex life cycle of the organism has at least 24 distinct stages that range from a sediment-dwelling cyst to a free-swimming zoospore. Certain stages may release toxins that affect the neural and immune systems of fish. They also directly or indirectly cause fish skin to blister and slough off, creating sores that are then invaded by opportunistic pathogens such as bacteria and fungi.

Because this unusual organism has raised questions about human health, consumer safety and water quality, the N.C. Department of Environment, Health and Natural Resources (now the Department of Environment and Natural Resources) set aside funds for studies of *Pfiesteria*-like organisms. North Carolina Sea Grant administered the funds and awarded them to scientists at Duke University, East Carolina University, North Carolina State University and the University of North Carolina at Chapel Hill.



Carla Burgess

the health and habits of
in fish-kill areas.

Crabbing requires fishers to spend hours on the water placing and pulling pots.

Courtesy of Hans Paerl

Hans Paerl (left) samples an IMS mesocosm with Matt Fitzpatrick, a former technician. They are studying how algae respond to the addition of nutrients.

Human Health Effects

In one study, a team of ECU researchers compared the health and habits of crabbers to those of a group of nonfishers. The team also examined where crabbers set their pots and where fish kills, algal blooms and other water quality problems have taken place.

The researchers concluded that casual contact with eastern North Carolina waters under normal conditions — in the absence of fish kills, algal blooms, red tides or other indicators of poor water quality — poses extremely low health risks. Reports of ill-health effects caused by high concentrations of *Pfiesteria*-like organisms during fish kills appear to have been "greatly exaggerated," says David Griffith, the ECU anthropologist who headed the research team.

Griffith notes that North Carolina has water quality problems, but his research did not find a link between poor water quality and bad health.

"The threat is exaggerated for the human population. But I can't speak for fish," Griffith says. "This is a very narrow kind of finding that people who work all day on the water for their entire lives are not sick just because of that."

In 1996, the researchers interviewed 253 crabbers who worked in the Neuse and Pamlico rivers and in the southern sections of the Pamlico Sound (Pamlico crabbers). They compared the crabbers' replies to questions about their recent health to responses from two control groups: 115 crabbers working in Albemarle and Currituck sounds, the Alligator River and northern areas of the Pamlico Sound (Albemarle crabbers) and 125 nonfishers living in the crabbers' communities.

Continued

Heterosigma – Devastating to Aquaculture

Chocolate-brown waters are a sign that *Heterosigma carterae* is blooming. To aquaculturists on the West Coast, these brown waters forewarn a loss of green in their pockets.

The *Heterosigma* toxic algae has been reported on every continent except Antarctica, and it has caused multimillion-dollar fish kills worldwide, says Rose Ann Cattolico, a Washington Sea Grant research scientist.

Sea bream, salmon, yellowtail, sea bass, trout and flounder have been killed by *Heterosigma* blooms. In the Pacific Northwest salmon industry, losses have reached more than $20 million over the past eight years, and Japan estimates that *Heterosigma* has cost its aquaculture industry more than $2 billion over a 16-year period.

Beyond this economic havoc, the ecosystem suffers as well. "You don't have to have lots of dead fish in the water in order to have an effect on your ecosystem," Cattolico says. "There are many impacts on many organisms and at different levels."

Specifically, *Heterosigma* blooms can interfere with the survival and reproduction of invertebrates. When juvenile oysters or clams are fed *Heterosigma*, their growth rates are 20 percent lower than those of shellfish fed *Skeletonema costatum* (healthy food for oysters). Adult shellfish are not directly affected by *Heterosigma*, but oysters refuse to feed when this toxic algae is in the water.

"And if they aren't feeding, they're not surviving with the same success rate," Cattolico says.

Likewise, sea urchin eggs will not grow at all in water where *Heterosigma* is present. For aquaculturists who cater to Asian markets where people covet sea urchins as a meal, *Heterosigma* can be a devastating setback to business. ◘

—J.F.N.

The researchers found that in most cases, the two groups of crabbers and the community controls reported similar levels of illness and injury. However, both groups of crabbers reported higher — and nearly identical — incidences of skin disorders than the community controls. The researchers concluded that skin disorders are a common occupational hazard among crabbers and cannot be attributed to *Pfiesteria* or similar dinoflagellates.

Increased exposure to water (as measured by the number of traps the crabbers pull per day) did not result in increased incidence of illness. And there was no statistical difference in levels of illness between those who worked in areas with fish kills and those who worked in areas with few or no kills. The two areas known to have had fish kills — the Neuse River and the Pamlico and Pungo rivers — did have lower well-to-ill ratios than areas less prone to kills. This finding may be some cause for concern about the human-health impacts in these areas as opposed to others, the researchers reported.

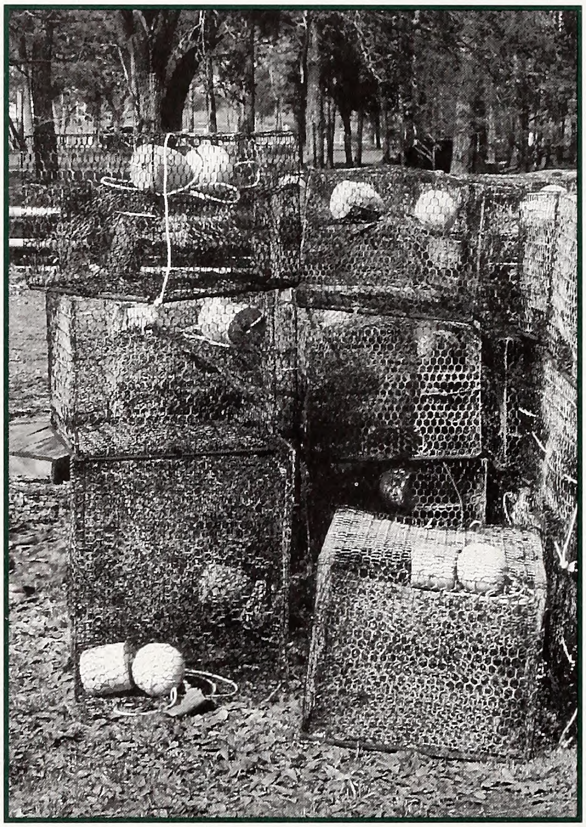
Learning Impairment in Rats

In another study, Duke University scientist Ed Levin found that rats injected with *Pfiesteria* display a significant learning deficit when called on to attempt new tasks as long as 10 weeks later. Levin's work was published in the December issue of *Environmental Health Perspectives*, the journal of the National Institute of Environmental Health Sciences.

"It seemed to be relatively specific in that the rats seemed to be otherwise healthy and their appearance seemed normal," Levin says.

In addition to appearing physically well, the rats showed no *Pfiesteria*-induced effects in blood count or in a standard pathological screening of brain, liver, lungs, kidneys and spleen.

Water samples were taken from aquariums in which *Pfiesteria* were killing fish. The samples were frozen, thawed and injected into rats. The significant learning impairments were documented in rats required to learn a new task after they received recently frozen injections of *Pfiesteria*. However, no effect was seen in the recall of previously learned tasks. These tests were not carried out beyond 10 weeks.



Griffith estimated each crabber's exposure to the water by the number of pots he or she worked.

The persistent learning impairment in rats might be comparable to the cognitive deficits humans have shown after exposure to *Pfiesteria* in the lab, the researchers concluded. The findings were replicated in several studies, but more are needed to determine which chemical causes the effects, Levin says.

"We're going through different extracts to see which (chemical) is the bad actor," Levin says. "We're using procedures to help identify the critical toxin, the critical chemical in *Pfiesteria*."

From that information, researchers can help determine what exposure levels warrant concern and develop therapeutic treatments for the learning deficits.

Environmental Causes

At the UNC Institute of Marine Sciences, researchers Hans Paerl and James Pinckney examined whether nutrients spur growth of the dominant nontoxic zoospore stage of *Pfiesteria* and whether nutrient-induced increases in phytoplankton — a primary food source for *Pfiesteria* — boosted the dinoflagellate's numbers.

They concluded that *Pfiesteria* does not respond strongly to the addition of nitrogen and phosphorus — nutrients that commonly reach state waterways through runoff and discharge pipes. But phytoplankton do respond to nitrogen, and increases in phytoplankton appear to direct changes in *Pfiesteria*-like zoospores. Thus, it appears that phytoplankton are the nutrition source that supports the growth of *Pfiesteria*-like zoospores.

"We saw the prey organisms increase, but we didn't see *Pfiesteria* increase at the same time," Paerl says. "That says that a slug of nutrients that enters the river probably doesn't have an immediate short-term stimulator effect on *Pfiesteria*, but in the long term you can see a pattern."

Their experiments used water from a location on the Neuse River where both *Pfiesteria* and fish kills have been reported. The water was transferred to mesocosms — translucent fiberglass tanks. The scientists then simulated natural conditions and added inorganic nitrogen and phosphorus. These forms are the most likely types of growth-stimulating nutrients encountered by phytoplankton and *Pfiesteria*-like dinoflagellates in the Neuse estuary.

Paerl and Pinckney concluded that reducing phytoplankton growth would translate into broad water quality improvements, including a decline in the frequency and magnitude of algal blooms, oxygen depletion, and fish and shellfish deaths.

The Neuse River, in particular, would benefit from proposed nutrient-reduction strategies to improve its water quality and reduce fish mortality, Paerl says.

"By reducing nitrogen loading and reducing the major phytoplankton responses that we saw in bioassays, it's likely to help minimize outbreaks of *Pfiesteria* as well," he says.

The results confirmed 10 years of nutrient-addition experiments on the Neuse River, showing the importance of nitrogen as a growth-limiting nutrient, Paerl says.

Exposure to Seafood

Meanwhile, Duke University scientist Patricia McClellan-Green and NC State University researchers Lee Ann Jaykus and David Green studied the possibility of consumer health risks from eating fish exposed to *Pfiesteria*. They wanted to know if fish exposed to the dinoflagellate absorb its toxin.

The fish used in the study were collected live on Sept. 3, 1996, during an active kill on Northeast Creek, a tributary on the upper portions of the New River. The scientists used fillets — edible portions of the fish — for their studies.

The team reported that only one species of fish sampled from the kill site — Atlantic menhaden — had toxin in its tissues. But because other dinoflagellates were present in the water, the team had no way of knowing whether the toxin was from *Pfiesteria*. Other fish collected at the same time — spot, striped mullet, croaker, Spanish mackerel, silver perch and pinfish — did not appear to contain toxins.

"The fact that none of the tissues from other fish was positive is very encouraging," McClellan-Green says.

The researchers are confident that the test they adapted for this research can be used as an early screening method for fishery products and water samples collected at the site of fish kills. They are continuing to refine these techniques and use them with other methods for detecting *Pfiesteria* toxins in the environment.

Rather than ending inquiries into the effects of *Pfiesteria*, these four peer-reviewed research projects help to identify areas that need further exploration, says Sea Grant Director Ron Hodson. He emphasizes that the work is just beginning.

"With the interest of federal agencies and state agencies, I'm very optimistic that funds will be made available to continue that research," Hodson says. ◘

Brown Tide – Deadly to Shellfish

Brown tide is a destructive algal bloom that can starve shellfish, damage critical nursery habitat and interrupt the marine food web.

Its blooms are caused by a bacteria-sized algae, *Aureococcus anophagefferens*, during the late spring and summer in coastal embayments from Narragansett Bay, R.I., to Barnegat Bay, N.J., says Darcy Lonsdale, a New York Sea Grant researcher. Different brown tide species are found in the Gulf of Mexico.

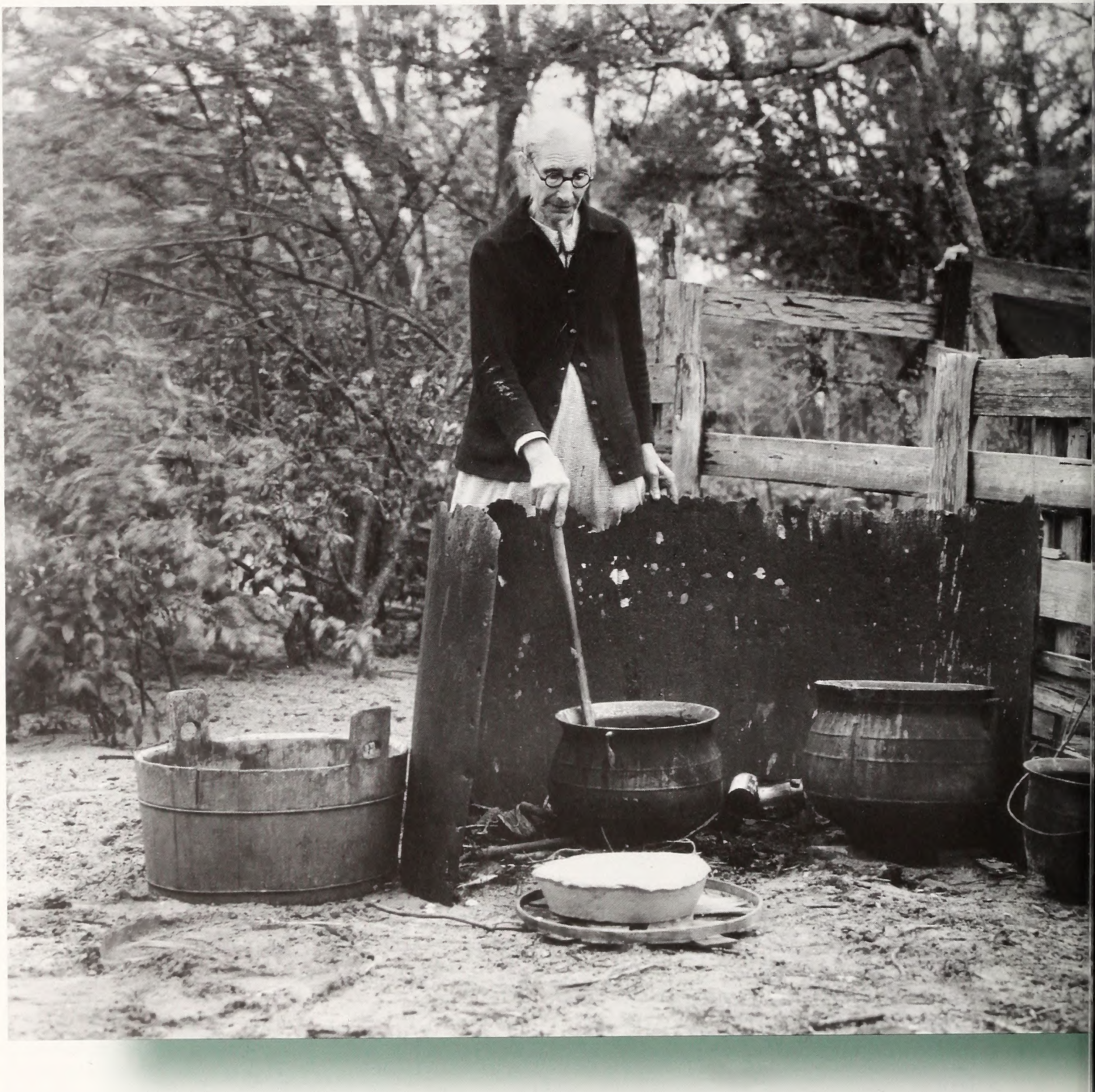
"There is no reason to suspect that this alga is directly harmful to humans," Lonsdale says. "But we are concerned because it is apparently quite harmful to organisms that consume phytoplankton."

Brown tide can starve shellfish – especially mussels, scallops and hard clams – by reducing their feeding response. Juvenile hard clams tend to grow slower during brown tides, and scallops seem to stop feeding when concentrations reach 250,000 cells per milliliter of seawater (a milliliter equals about 20 drops) – the point at which researchers begin to see negative effects. At times, brown tide blooms reach concentrations of more than 1 million cells per milliliter.

"When shellfish are out in the bay and they start to experience higher and higher concentrations of brown tide, they stop feeding, close up and starve," Lonsdale says.

The price for these outbreaks in terms of lost seafood sales can be steep. In 1988, New York state suffered a $2 million loss from reduced scallop landings caused by brown tide.

Besides starving shellfish, brown tide damages habitat by darkening the water and diminishing the light needed by bottom-dwelling eelgrass, a nursery and refuge for many fish species. The algae also interrupts the food web at about 500,000 cells per milliliter by decreasing protozoa, a key nutritional link between phytoplankton and their predators, such as some juvenile fish. With less food available, juvenile fish may grow more slowly or die. ◘ –J.F.N.



Mis' Bashi had only five weeks of schooling, but in 45 years of delivering babies she learned to improvise and reassure frightened women.

Photo by Clifton Adams, the National Geographic *Image Collection*

Mis' Bashi & the Lady Doctor

By David Cecelski

Whenever I visit North Carolina's older coastal cemeteries, I am always moved by the small gravestones etched with little lambs and baby angels. Often I find them clustered together — three, four or even more children from a single family. And it's not unusual to discover a young mother buried nearby. At the Harlowe United Methodist Church, between Beaufort and Havelock, is a typical cluster of graves, all children of Craven and M.T. Taylor: Vernon, age 2; Earl, 9 months; Lila, 4 months; Nina, 12 days; and Daisy, who was born and died the same day. You'll find similar heart-wrenching scenes in nearly every graveyard established before World War II.

These gravestones bear witness to the dangers of childbearing and childhood diseases before the advent of modern obstetrics and vaccines. Even as late as 1910, one mother out of 30 died during childbirth (compared to fewer than 1 in 5,000 today). Every pregnancy forced a woman to contemplate the possibility of her own death even as she readied herself to bring life into the world. And, as if childbirth weren't perilous enough, a host of infectious diseases — from typhoid fever to diphtheria — posed a lethal threat to every mother's child.

Though the far lower death rate in childbirth and infancy is one way that our day differs profoundly from that of our grandparents, we rarely find historical records that illustrate how the "shadow of maternity" shaped coastal women's lives. Childbirth and children were considered part of women's sphere and, as such, a private affair not really a part of history. Even midwives and physicians rarely left written accounts of their experiences delivering babies and caring for young children.

One important exception was an Outer Banks midwife named Bathsheba Foster and a woman physician named Blanche Nettleton Epler. They were an unlikely pair: an illiterate, self-taught midwife who had delivered babies for 45 years and a worldly Midwestern doctor who was one of the first women to graduate from the Johns Hopkins School of Medicine and the first woman appointed to the U.S. Coast Guard. Their story, which unfolds in an article Epler wrote for *National Geographic* in 1933, offers at least a glimpse of the shadow of maternity and the women healers who struggled to dispel it.

Epler had cared for women and children many years before she met "Mis' Bashi" at Hatteras Island in 1923. Nearly 60 years old then, she had grown up in an upper-class family in the small town of Jacksonville, Ill. She was one of only two women in the Johns Hopkins class of 1899. (Hopkins was the first mainstream U.S. medical school to admit women, stipulated by a group of women patrons who donated $500,000 to found the medical school in 1893.) She interned

Continued

at the New York Infirmary for Women and Children, then was a general practitioner, college teacher and public health pioneer in Kalamazoo, Mich., from 1901 to 1923.

I don’t know why Epler left Kalamazoo to accept a U.S. Public Health Service posting to the Coast Guard station at Hatteras. She never married or had children, and she gave up both many personal comforts and access to the latest medical technologies to come to the Outer Banks. Moreover, she had built a successful career in Kalamazoo. She had cofounded a Methodist hospital, two nursing homes and the local Girl Scouts, and she had served as the city’s bacteriologist.

Dr. Blanche Nettleton Epler, #14 in the photo (second row, second from left), poses with her classmates in the Johns Hopkins School of Medicine class of 1899. She was one of the first women to graduate from the school.

Certainly, Epler had an adventurous spirit. Women physicians of that day tended to be daring or they would never have broken into medicine in the first place. At the same time, Epler had a deep commitment to public health that may have inspired her to serve at Hatteras. She seems to have found the Outer Banks an exciting opportunity to prevent needless deaths from childbearing as well as from infectious diseases such as tuberculosis that had proven treatable with improved public health practices. She had earlier been involved in public health campaigns in Michigan and in the hookworm crusade in the South.

Beyond her spirit of adventure and her commitment to public health, Epler also may have left Kalamazoo to find a more meaningful way to pursue her calling at a time when the status of women physicians was declining. The percentage of women among all U.S. physicians had peaked at about 6 percent in 1900, when women were enrolled at a large number of all-female medical schools and a few coed medical schools. As medicine grew more professional and scientific after 1910, the all-women’s medical schools were forced to close and coed medical schools allowed only small numbers of women to enroll, a policy that lasted until the 1970s.

Increasingly, women physicians like Epler practiced in remote locales such as Hatteras. Outlying communities found recruiting male physicians difficult, and their less rigid, almost frontier-style society usually left more room for women to emerge as leaders. Also, these communities often showed greater tolerance of nonconformist women in general. Indeed, the Outer Banks itself had long been renowned for strong women who could handle a fishing boat as well as a frying pan.

As the only physician on Hatteras Island, Epler served both the Coast Guard and the broader community from 1923 to 1925. When Epler arrived aboard the mailboat from Roanoke Island, Mis’ Bashi welcomed the doctor into her cottage by Pamlico Sound. They lived together until Epler had her own house built, and Epler believed that she had found a kindred spirit from their first meeting. She described the 78-year-old midwife as “comely and agile, her visage one of strength and thought.”

Sharing cornbread and coconut cake, Mis’ Bashi told the lady physician her life story that first night. She was descended from a Devonshire, England, castaway and had gone to school for only five weeks as a girl. Epler noted that “she had never learned to read, but had been taught to work indoors and out and to spin.” Mis’ Bashi was known, Epler said, as a “couthy woman,” an Outer Banks term for a capable, self-reliant woman.

Mis’ Bashi had taken care of others all her life. She nursed her chronically ill mother for years, and she raised her younger siblings, her own six children and her brother’s children. “Then for 45 years,” Epler wrote, “she ministered to all the sick of the region, a local doctor coming only at rare intervals.”

Midwifery was a demanding craft. When a pregnant woman needed her, Mis’ Bashi traveled for hours through the hottest summer days and stormiest winter nights. Her sand pony, Napoleon, pulled her in a two-wheeled cart. “She was smart, exact and knowing," Epler discovered. "She established her own art of medicine and it worked." When Epler asked how she had become such a successful midwife, Mis' Bashi said only, "Doctor, I had a good mom and learnin' to work. My own mother wit and being mindable to what a good doctor was tellin' me made me fitten to do it."

Old gravestones tell the poignant story of the dangers once posed by childbirth and childhood disease.

Midwives such as Mis' Bashi often moved into a mother's home for days or even weeks. Preterm labor or a complicated pregnancy required her to arrive at the bedside early rather than wait until contractions had started, and she probably stayed until the mother was ready to care for the child herself. "Her fee at first was $2.50 for the care of mother and babe," Epler wrote, though "later this became $3 and now $10."

Like much of the historical record, Epler's *National Geographic* article is vague about how she and Mis' Bashi actually handled deliveries. We can imagine the pair's skill and ingenuity from other nursing cases that she describes in more detail. When a fisher named Nevada arrived with a stingray tail embedded in his leg, Epler had not yet received her medical instruments from Kalamazoo. She and Mis' Bashi improvised tools out of cut-down lard and coffee cans, then rustled up their own treatment out of turpentine and coal oil, hot water and soap, and Epler's one bottle of Mercurochrome. Stretching the patient across the kitchen table, Epler cut away the stingray's tail, aided, she said, by "Mis' Bashi's 'mother wit' and her nimble, clean hands."

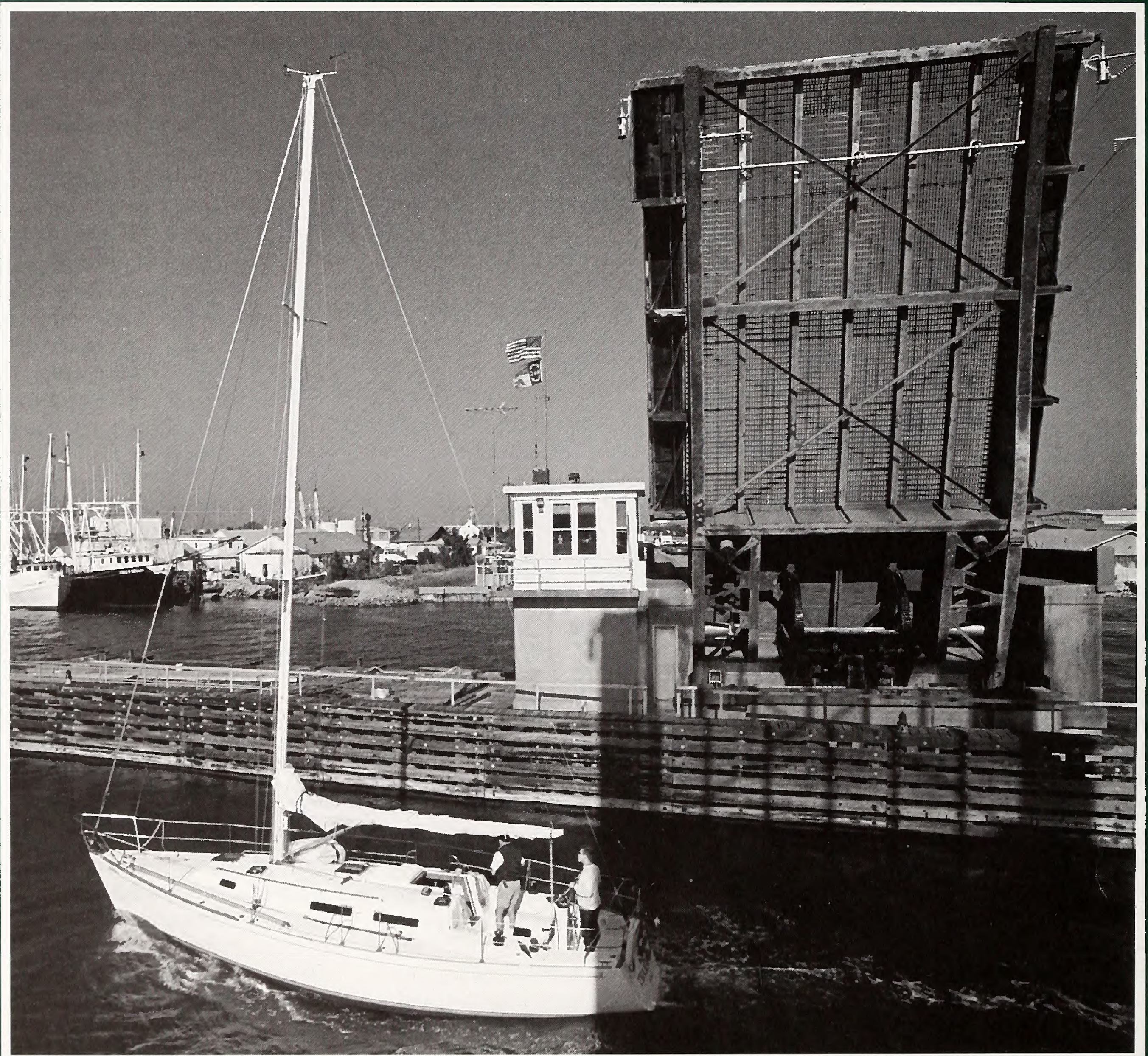
Epler witnessed the last days of traditional childbirth: at home, low-tech, under women's control, tended by a midwife. However, she didn't always understand the community's handling of childbirth. When she attended the eighth delivery of a woman named Mrs. Vienner, Epler observed that "a bevy of silent, sitting women, useless and immovable, lined the room and porch."

This congregation of women outside Vienner's home was an island custom. The father and other men withdrew from the home altogether. The expecting mother's closest female relatives and friends comforted her in the birthing room, while community women waited in silent vigil — sometimes in prayer, sometimes just as a quiet gesture of solidarity. I doubt the women in labor considered them "useless." As mothers themselves, they reminded her that she too could make it through the shadow of maternity.

Although Epler failed to understand some of the island's childbearing customs, her medical skills seem to have been appreciated. A few decades earlier, even a Johns Hopkins-educated physician like Epler would not have had much to offer Mis' Bashi or Hatteras mothers. But by the 1920s, obstetrical advances — especially the use of anesthesia, new procedures for suturing perineal tears and a vigorous appreciation for aseptic delivery — had made childbirth less perilous and painful. At Hatteras, with no hospital, Epler and Mis' Bashi delivered babies with elements of both traditional midwifery and modern medicine, but nationwide, midwifery was gradually falling out of favor as childbearing moved into hospitals.

Epler left Hatteras in October 1925 for the Phipps Clinic in Baltimore. She returned to the Outer Banks to practice general medicine in 1929 but found that the "garish lure of 'civilization' had taken its toll." She praised the older islanders like Mis' Bashi for "their willingness to help humanity in every way" but railed against the first automobiles, the clubs of wealthy duck hunters and even the young people's rage for "high heels and rouge, and picture shows."

By 1933, Epler had moved away from Mis' Bashi and back to her childhood home in Illinois. For a few brief years, however, the lives of these two women crossed, leaving us an extraordinary portrait of their arduous labors to bring women and children out from under the shadow of maternity. United by mutual respect and a commitment to their patients, a modern scientific physician and a traditional healer brought the best of old and new to the Outer Banks. ◘



The Grayden Paul drawbridge lifts skyward
to allow watercraft easy passage into Beaufort's harbor.

DRAWING CONCLUSIONS:

Meditations on an Old-Fashioned Bridge

BY JULIE ANN POWERS • PHOTOS BY SCOTT D. TAYLOR

If living at the edge of the ocean isn't reminder enough of human humility, consider the Grayden Paul Drawbridge.

The creaky little span over Gallants Channel near Beaufort splits open three times an hour when the weather is warm and boat traffic busy.

When it does, it becomes the great leveler on land. All cars are created equal. Everybody has to stop where they are. Everybody has to wait, be patient and take their turn. Everybody has the time to consider that they are neither the center of the universe, nor is their mission of great cosmic importance.

This powerlessness, however impermanent, is unbearable for many. The campaign to rush construction of a high-rise replacement grows louder by the day.

But some of us in Beaufort are quite fond of that old bridge. Some of us savor its influence on daily life. We don't desire improved connection to the mainland. We see the drawbridge as a welcome line of demarcation from it.

To us, the drawbridge is more than outdated engineering. It is a philosophy of simplicity. It is a metaphor for minimalism. And it is indisputable evidence that this is an altogether different sort of place.

Every 20 minutes as its siren wails and its draws lift skyward, it announces that here, at least for some, the rhythm of life is still dictated more by tides than time clocks. That here, boats and whatever business they are about still matter.

A deep affection for boats often coincides with a soft spot for this bridge. For some of us, it is impossible to look upon a sailboat and not wonder where it's bound and where it's been. It is impossible to watch a stout fishing trawler rumble by and not wonder, even just a little, about the wife or daughter whose name it bears.

We do not see just vessels going through the bridge. We see romance. We see adventure. We see destiny.

Even if not beguiled by boats or beholden to them, the bridge offers frequent opportunity to inventory the infinite wonders of where we are.

The tides that wash so fast beneath the draws are part of the sea itself. Beaufort Inlet, a portal to all the world's oceans, is so close you can often count the waves. Beyond its deep channel, great ships bound for the state's ports rest at anchor. Even these giants look small against the endless, bottomless salt water.

Closer at hand, dolphins and shorebirds move in graceful arcs across the waterscape. A turn toward Town Creek in summer adds the delightful sight of a dozen tiny sailboats seeking the sea breeze. The young sailors are students of the Maritime Museum's junior sailing program, the wee wooden boats lovingly built by volunteers.

This, too, is where I often take my own little boats. So sweet is the sailing of a fine small boat in this pretty harbor that the periodic lifting of the drawbridge is the only hint of passing time.

My diminutive craft can easily pass beneath the closed drawbridge. But I've spent some time — lots of time — on bigger boats waiting for the Beaufort bridge and others along the Atlantic Intracoastal Waterway to open.

Like the Grayden Paul, most of the aging Intracoastal bridges are subject to increasing car traffic. And, like the Grayden Paul, most are under pressure to further limit openings until big bridges can be built.

Many drawbridges will not open at all during land rush hours now. But having done both, I can say that waiting is far more trying on the water than on the highway, especially in an open cockpit and a cold wind. Just a little bad luck or bad timing can rearrange plans for the whole day, the whole voyage. My indulgence of drawbridges at these vexing moments sometimes wavers.

Unpredictability, however, is the nature of boat travel, and by necessity those aboard usually are patient and easygoing. Otherwise, we wouldn't choose a method of transportation far older than the covered wagon and just as slow.

If I have to leave Beaufort at all, I prefer to do so by boat, even if it means waiting for the bridge. I often fail to execute the departure by land. The drawbridge is a conspirator in this, particularly when the motivation is material goods not available on my side.

A sign on the approach reads simply "Drawbridge," but it seems to

Continued

say so much more. "You don't really want to go," starts the chant in my head when the sign comes into view. "You don't really have to go. You can live without it. You don't really want to go ... ."

Often as not, the argument is convincing. I turn toward home instead, time and money saved and my soul untried by the crossing.

Among those who think like this, any trip west of Beaufort, whether the destination be Morehead City or Sacramento, is solemnly spoken of as "crossing the bridge." This worrisome phrase does not refer to the drawbridge. Getting to the mainland via U.S. 70 requires crossing two bridges — the draw and a high-rise span beyond it.

"The big bridge" is what stirs the undefined dread and vague but acute anxieties. Perhaps we are unnerved by the unaccustomed height above the sea-level landscape. Or because, from its 65-foot peak, one plunges fast into a much busier place than Beaufort. There seems an unspoken burr of worry we'll be swept away in the current of so much commerce or trapped in the eddies of all that industry.

AS BOATS GLIDE THROUGH THE OPEN DRAWBRIDGE ...

TRAFFIC SNARLS AND PATIENCE EBBS.

A causeway, on a long and slender strip of sand rising just above the marsh on either side, connects the two bridges. It provides a needed avenue of transition when leaving, a stretch to prepare oneself for what is to come. Heading back, it becomes a runway of happy anticipation.

The Grayden Paul itself is the Great Divide. The hiss of tires across the metal mesh of its movable parts is a warning when outbound, a welcome sigh of relief upon return.

My love for the bridge is a luxury, of course, and my love is conditional. It is contingent on a lifestyle deliberately kept unencumbered and the freedom to not cross the bridge when I come to it.

And it is a love doomed. This is an age of instant access, of Concorde jets and instantaneous e-mail. Great expectations have crossed Gallants Channel. A stopped automobile has been deemed intolerable. The drawbridge has been declared the mortal enemy of progress.

So, sooner or later, a bigger bridge will rise here. And with it will come the unimpeded access big bridges bring. With it will come the crowds, and convenience and all its complications, the things that eventually make islands less like islands and more like everywhere else.

There will be no more interruption in the roadway, no pause to ponder the mission at hand, no interlude of awe at the surroundings.

There will be only the sweep of concrete ascending in an arch unbroken between the shores. There will be only the dark curve of its shadow on the water below. A curve that, to some of us, from a certain angle, will always resemble a question mark. ◘

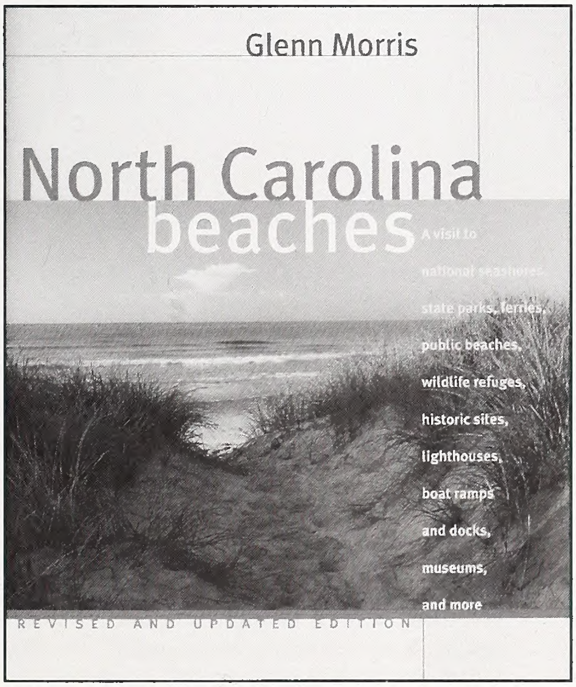
Guided Tours of the Coast

Where to Go, What to See and How to Get There

By Daun Daemon

Where are the least crowded beaches in North Carolina? The most fun and educational coastal activities for the kids? Places that satisfy a craving for culture or history? In this issue, *Coastwatch* rounds up a handful of guidebooks that will help you discover — or rediscover — the North Carolina coast's hot spots and hidden treasures.

- *North Carolina Beaches: A Visit to National Seashores, State Parks, Ferries, Public Beaches, Wildlife Refuges, Historic Sites, Lighthouses, Boat Ramps and Docks, Museums and More* by Glenn Morris. Revised and updated edition. 1998. The University of North Carolina Press, P.O. Box 2288, Chapel Hill, NC 27515. 294 pages. Paperback, $17.95. ISBN 0-8078-4683-X.


Glenn Morris
North Carolina
beaches
A visit to national seashores, state parks, ferries, public beaches, wildlife refuges, historic sites, lighthouses, boat ramps and docks, museums, and more
REVISED AND UPDATED EDITION

For an all-purpose guide to the North Carolina coast, you can't beat Morris' book. He visits all of the places mentioned in the subtitle, writing about them in refreshing detail and with an eye to local color. Many good fact-filled guidebooks are dry, but they accomplish the goal of getting readers where they need to go. Morris does so much more.

He tells you how to gain access to the beach, a simple-enough task. But he seems compelled to make you understand the places, appreciate their history and natural splendor, know their people and feel a part of the forces that shaped the North Carolina coast's unique environments.

Morris begins the guide with a history lesson: how the coastal geography was formed and the land eventually settled. He quickly moves to giving a crash course on beach access, explaining that the heart of the problem is limited parking. From there, he travels down the coast county by county and through the two national seashores, beginning each chapter with an overview. For each location, he provides general information and handicapped access information, if available. When applicable, he indicates regional access sites, local access sites, dune crossovers and unimproved access areas.

While these detailed explanations of access, services and recreational offerings are useful and well presented, the real joy of this book is all the extras Morris provides. His gifts include illuminating tidbits that indicate the character of a place. Of Harkers Island, he writes that it "stands alone, a village that is off the beaten track. You must aim to go there since it

Continued

tucks into the inside of the elbow of Cape Lookout. It is likely that a fair number of people discover it by mistake ... .”

The most entertaining writing in the book is found in the 27 feature essays peppered throughout. In them, Morris provides updates on coastal bird species (“The Plight of the Piping Plover”), explains natural forces (“The Shapes of Islands”) and reveals a bit of history (“U.S. 17, the King’s Highway”).

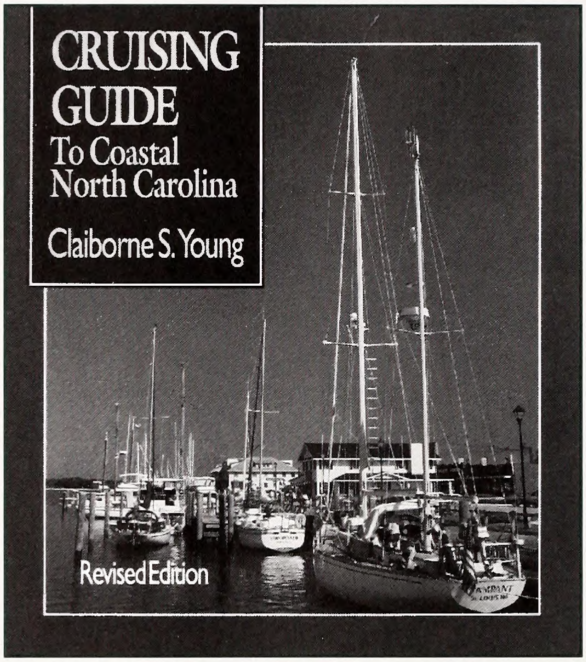
Morris doesn’t ignore the essentials. In appendices, he pulls together information on parks, reserves and other attractions; festivals and events; and saltwater fishing tournaments. The maps in this guide are the most detailed and easiest to understand of the books reviewed in this column. And the black-and-white photographs — which depict the natural places, man-made landmarks and critters of the coast — add interesting views of the places Morris takes you.

- *Cruising Guide to Coastal North Carolina* by Claiborne S. Young. 4th edition. 1997. John F. Blair, Publisher, 1406 Plaza Dr., Winston-Salem, NC 27103. 364 pages. Paperback, $24.95. ISBN 0-89587-204-8.

While most people tour the coast by its highways and back roads, those with sea legs know that the view from the water is just as beautiful and revealing. Young, who has penned cruising guides for other southeastern states, offers careful, expert advice on navigating North Carolina’s waters and enjoying the attractions along the way.

The book is organized to take boaters from the Albemarle Sound in the north down the coast to Calabash Creek. The reader cruises the major waterways — the Croatan, Roanoke and Pamlico sounds; the Pamlico and Neuse rivers; Core Sound; Bogue Inlet; and the Cape Fear River — and takes side trips into smaller creeks, bays and inlets. For each major course, Young lists the National Oceanic and Atmospheric Administration charts necessary to negotiate the waters.

Though Young provides detailed directions for getting through the waterways, he does not intend for the book to teach novices how to boat. “I am assuming that you have a working knowledge of piloting and coastal navigation,” he writes. “If you don’t, you should acquire these skills before tackling North Carolina’s coastal waters.”



And from Young’s descriptions of sights along the way, tackling the waters is worthwhile. With this book in hand, boaters will discover many interesting shoreside attractions and satisfying restaurants close by the docks. Young also includes legends and folktales to enliven the cruise.

The book’s many maps are crisp and easy to understand, but most of the black-and-white photographs are small and provide only dim views of their subjects. Checklists of services offered at various marinas are helpful, as are sidebars with very specific directions on navigating water bodies such as Core Sound and the upper Cape Fear River.

- *Touring the Backroads of North Carolina’s Lower Coast* by Daniel W. Barefoot. 1995. 363 pages. Paperback, $15.95. ISBN 0-89587-126-2; and *Touring the Backroads of North Carolina’s Upper Coast* by Daniel W. Barefoot. 1995. 365 pages. Paperback, $15.95. ISBN 0-89587-125-4. Both published by John F. Blair, Publisher, 1406 Plaza Dr., Winston-Salem, NC 27103.

If your taste in guidebooks runs to a text that reads like a novel, then these back roads books will suit you. Easily read from beginning to end, *Touring the Backroads of North Carolina’s Lower Coast* and *Touring the Backroads of North Carolina’s Upper Coast* are packed with useful information on all manner of places in the eastern part of the state. In each tour, Barefoot takes you literally street by street through cities and towns and along coastal waterways. His style alternates between directions that are simple and direct — “Turn south on N.C. 172 and drive 1 mile, then turn east onto N.C. 210” — to storytelling that holds your attention for pages.

Between the two books, Barefoot outlines 24 coastal excursions. His 11 upper coast tours include the Great Dismal Swamp, Roanoke Island and the Pamlico Sound. Some of the many entertaining stories in that volume include the account of how Oriental got its name, the history of the Whalehead Club on Currituck Sound and the eerie tale of James B. Gaskill’s death in World War II.

The 13 lower coast tours take you

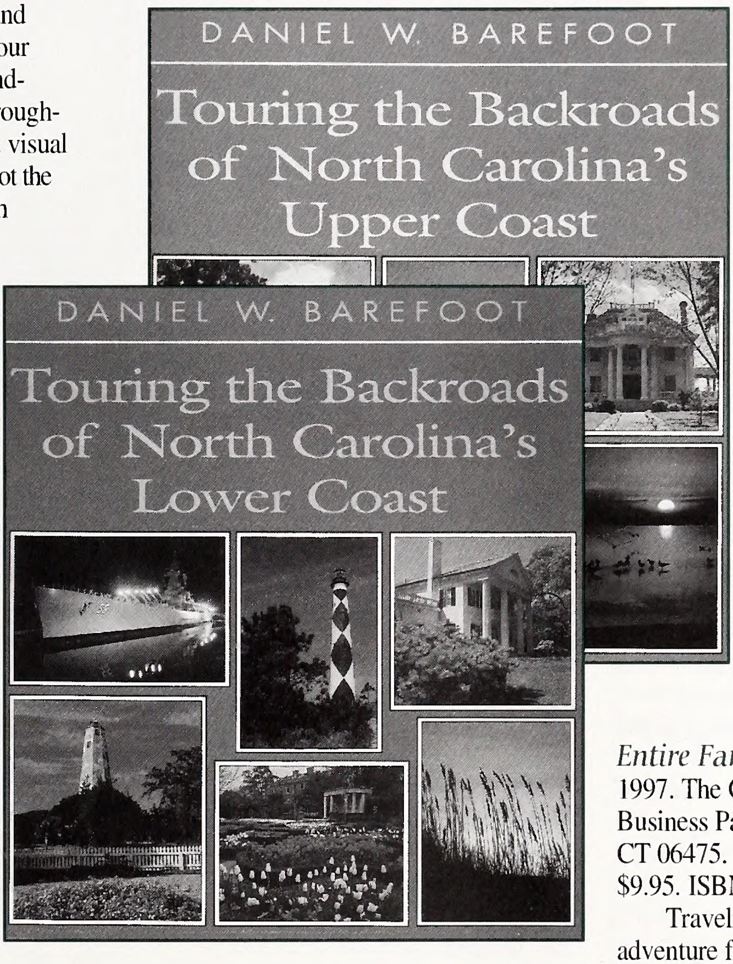
to places such as Pleasure Island, the Crystal Coast and the Land of Waccamaw. In this book, you'll find the story of the Maco light, an account of Polly Slocumb's heroics in the American Revolution and tales of buried treasure off Topsail Island.

The books include street maps of cities like Southport and Bath and more generalized maps of the tour areas. The many small black-and-white photographs scattered throughout are meant for reference, not visual appeal. They should help you spot the landmarks while you explore with Barefoot's book in hand.

Also worth mentioning ...

• *North Carolina Curiosities: Jerry Bledsoe's Outlandish Guide to the Dadblamedest Things to See and Do in North Carolina* by Jerry Bledsoe. 2nd edition. 1990. The Globe Pequot Press, 6 Business Park Road, Old Saybrook, CT 06475. 223 pages. Paperback, $9.95. ISBN 0-87106-528-2.

The title of Bledsoe's book tells everything you need to know about it, except the particulars. In the section covering the coastal plain, you'll find the mysterious hoofprints in which nothing grows, the state's oldest grapevine, the birthplace of Pepsi-Cola, the site of Babe Ruth's first home run, the world's oldest Hardee's, the world's largest frying pan, a girl buried in a keg of rum and many other curiosities. Some of the entries are less sensational, for example, the Country Doctor Museum and the National Hollerin' Contest. By carefully describing all of these dadblamed things, Bledsoe is able to incorporate a good bit of history as well. Even folks who have lived in North Carolina all their lives or traveled it from peak to point will discover some of the state's more colorful attributes between the covers of this book.


DANIEL W. BAREFOOT
Touring the Backroads of North Carolina's Upper Coast
DANIEL W. BAREFOOT
Touring the Backroads of North Carolina's Lower Coast

• *Short Bike Rides in North Carolina* by Judi Lawson Wallace. 1998. The Globe Pequot Press, 6 Business Park Road, Old Saybrook, CT 06475. 206 pages. Paperback, $10.95. ISBN 0-7627-0212-5.

Wallace takes you on two wheels from the mountains through the piedmont and sandhills to the coast. The 41 bike routes outlined in the book guide cyclists through lush countryside, along winding rivers, to historic sites and into city districts. For each tour, the author provides detailed directions, information on sights to see and places to find food and other conveniences, clear maps and descriptions of the rides. The seven coastal tours lead riders to well-known landscapes and landmarks: "Biking Bald Head Island" (8 miles), "Southport to Orton Plantation" (31.9 miles), "Swansboro Bicentennial Trail" (26.8 miles), "Bicycling through Beautiful Beaufort" (5.2 miles), "Ocracoke Island" (27.4 miles), "To the Lighthouse: Hatteras Island" (25.4 miles), "Blackbeard's Trace: Bath" (26.3 miles) and "Mattamuskeet Meander: Hyde County" (39.5 miles).

• *North Carolina Family Adventure Guide: Great Things to See and Do for the Entire Family* by James L. Hoffman. 1997. The Globe Pequot Press, 6 Business Park Road, Old Saybrook, CT 06475. 178 pages. Paperback, $9.95. ISBN 1-56440-751-9.

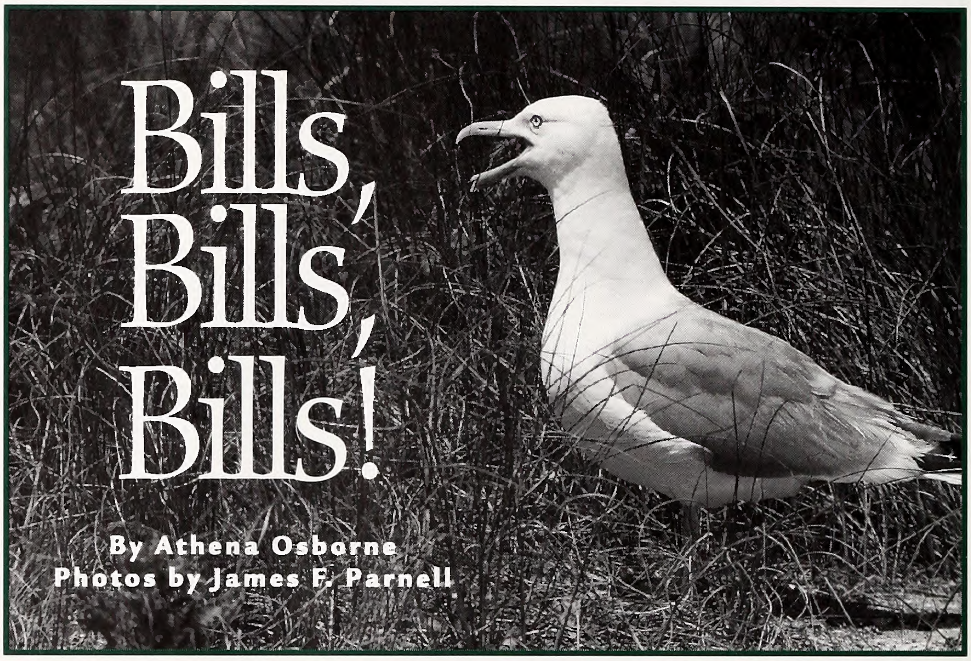
Traveling with kids can be an adventure for even the most patient parents. When the tots get bored or fidgety, it's time for distraction that's fun and educational. Hoffman's book is a good resource for roadtrip must-sees along the coast and in the other areas of the Tar Heel state. Descriptions are brief and include maps, directions, hours of operation and fees. "Jim's Top Annual Events," "Jim's Top Annual Attractions" and "Jim's Top Family Adventures" for each region will help parents on a tight schedule decide which sites to visit. ◘

NATURALIST'S *NOTEBOOK*

Bills, Bills, Bills!

By Athena Osborne

Photos by James F. Parnell



Herring gull

It scoops. It chomps. It dices and slices. The bill of a shorebird is the perfect gadget.

What does the bird eat? How does it hunt for food? Just look at its bill. The feathered fowl might not speak, but its beak can tell quite a story.

If you've been to the coast, you've seen a seagull, but have you ever really noticed its beak? The next time you spot a herring gull — a large, smooth, white bird with black-tipped gray wings — take a closer look. Notice how sturdy and heavy its yellow bill appears. Observe the spot of red on its lower mandible. Note the ever-so-slight downward curve of its upper mandible.

When you discover what the seagull eats, the versatility of its bill design makes sense. This scavenger gobbles up a diverse diet by foraging through garbage dumps or snatching bait and fish from behind fishing boats, places where competition with other scroungers can be fierce. It needs a bill strong enough to break bones and shells and to tear flesh and muscle, yet sharp and sturdy enough to pick up food scraps rapidly.

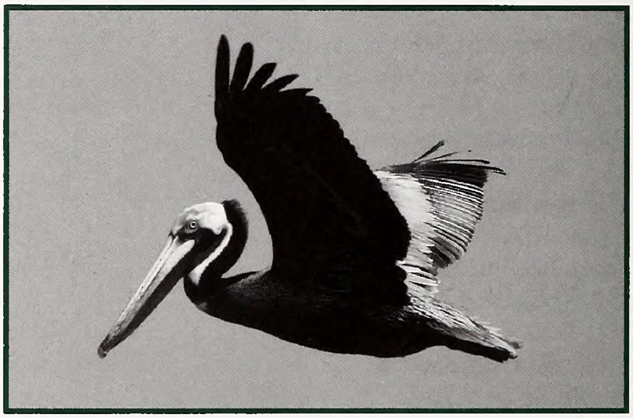
The gull also works the tidal flats for crabs and snails, so an extended upper mandible helps to extract these minimeals from sand, shells and debris.

This versatile beak is one reason for the gull's extensive domain. The ability to eat such a variety of foods makes the seagull one of nature's most adaptable birds.

Next time you visit the marina, check out the beak of the quirky bird that sits atop the pier posts and pilings. The brown pelican's long, bulky beak is not as precise as the herring gull's. But don't let that fool you. Its design is performance related too.

When the pelican is waterborne and bobbing on the waves, its tucked-in brown and yellow beak contrasts brightly with its dark brown and gray plumage.

When airborne and soaring up to 50 feet above the water, the bird's beak, despite its gargantuan proportions, is streamlined, aerodynamic and poised for action. Spotting prey from this lofty position, the pelican dips into a swooping dive, beak and neck extended, to spear through the water with a loud splash.



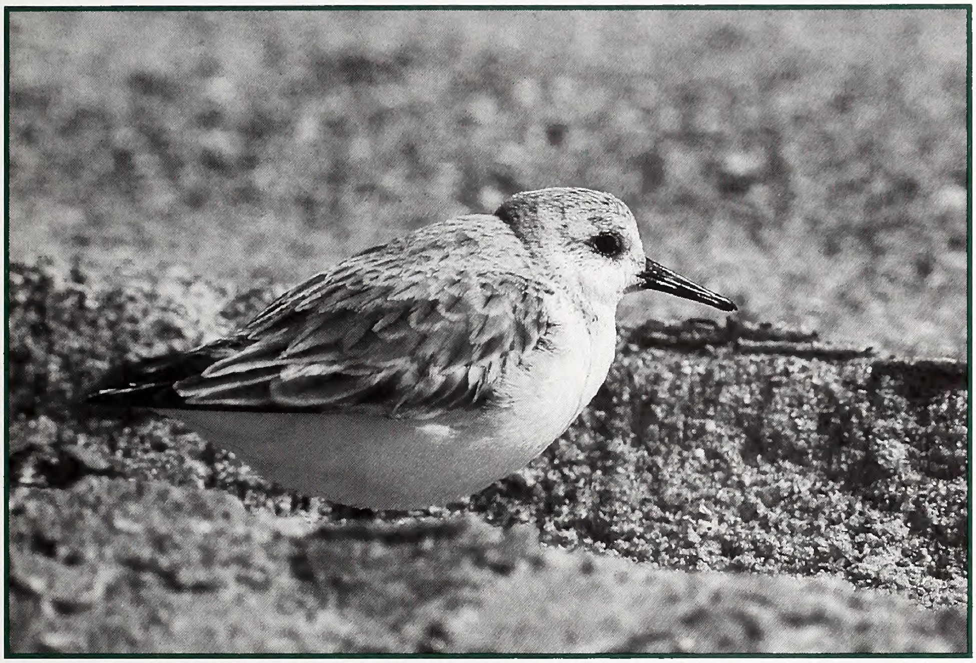
Brown pelican

Beneath the water's surface, the beak and lower throat undergo an amazing metamorphosis. As the pelican submerges itself and opens its beak, as much as 2.5 gallons of seawater flood into its lower throat area, expanding it dramatically. The result is a balloonlike sack that filters the seawater as it rushes out between the mandibles, leaving behind Atlantic menhaden, mullet or other small fish.

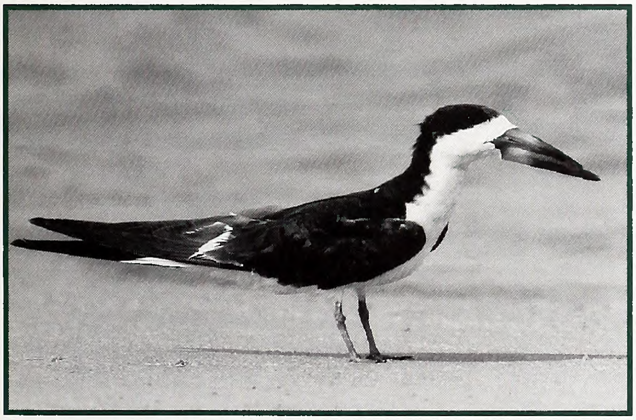
Not only is the amazing bill of this bird an efficient food catcher, it also functions as a feeder for chicks. When it's time to feed the little ones, the adult regurgitates food, opens its beak wide, and the babies, blind at birth, grope inside with their own tiny beaks. The straight, thin upper beak acts as an effective lid, jutting over the bottom beak in a downward-curved hook just as a latch would.

The sanderling, a type of sandpiper that weighs a mere 2 to 3 ounces, has more limited food foraging needs than both the seagull and the brown pelican. Its beak design reflects this.

You may have noticed this midget "wave catcher" scuttling back and forth



Sanderling



Black skimmer

along the surf line as if trying to avoid getting wet. Actually, it is looking for small animals buried in the sand that rush to the surface when an incoming wave passes and burrow when the wave recedes.

The tiny bird gobbles up the most lilliputian of waterfront meals — beach fleas, shrimp and small marine worms — by rapidly poking the wet sand of the swash zone, the area of beach between the high and low tide lines.

As you can imagine, eating tiny invertebrates requires less beak strength and more needle-nosed precision for tweezing prey from among the loose sand grains. For its hunt-and-peck method and specialized diet, the sanderling's sharp, tapered bill is ideal.

While the sanderling could be called hunter-gatherer of the surf, the black skimmer could be dubbed plow of the sea, resembling an agrarian tiller as it rakes the water's surface.

If you've spotted this elegant bird with its ebony upper body and white underbelly, you're fortunate. It is active mostly at night. Its bill is orange closest to its head and darkens to black from the midline of the beak to its tip. The upper and lower mandibles are compressed laterally into scissorlike blades, a key to the black skimmer's bizarre method of fishing.

The black skimmer harvests shrimp and small fish by skimming just above the surface of the water with its mouth agape and its sharp lower mandible actually submerged. Much like a pair of shears, it slices along until a small fish, shrimp or other crustacean bumps into its open beak. At that moment, the upper jaw reflexively clamps shut upon its prey.

The skimmer doesn't target a particular prey as most shorebirds do. Instead, it routinely plows an area of water, often over and over since vibrations of its earlier runs attract other fish.

Some other fish eaters such as the great blue heron have long, pointed bills to stab their prey beneath shallow water or to simply snatch and swallow. The white ibis eats small crabs or crayfish by extracting them from their burrows.

Whatever its peculiar shape and size, the beak determines the very survival of a beach bird. Flat, skinny, pointed, stumpy or slender — in many ways, the beak is what it eats. ◘

- How Birds Make a Living on the Coast *is a poster about birds and their bills. Send a $3 check payable to University of Georgia to Marine Extension Service, 30 Ocean Science Circle, Savannah, GA 31411-1011.*
- Birds and Mammals of the Cape Hatteras National Seashore *inventories birds and mammals in this national park and discusses the changes that time has brought for them. Send a $7 check payable to N.C. Sea Grant to Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. Ask for UNC-SG-92-01.*
- 1993 Atlas of Colonial Waterbirds of North Carolina Estuaries *describes 23 colonial waterbirds, details their breeding biology and nesting habits, and includes regional maps of colony sites. Send a $5 check payable to N.C. Sea Grant to Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. Ask for UNC-SG-95-02.*

Chill Out With Summer Seafood Salads

By Kathy Hart

Take the heat out of a sizzling summer day by serving a chilled seafood salad for lunch or dinner. Add some crusty bread, a light white wine and a medley of ripe, sugar-coated berries over almond-flavored pound cake to create a summer meal worth repeating.

Nutritious and easy to prepare, seafood salads can be made ahead and stored in the refrigerator overnight, allowing flavors time to blend and penetrate. The resulting salad can be served in small portions as a light first course or heaped on fresh lettuce as the main attraction.

As the primary ingredient for this summer delight, use cooked shrimp, crabmeat or flaked fish. Almost any delicate or moderately firm fish can be steamed, poached, broiled or baked, then raked with a fork into flakes.

For added flavor, marinate the fish prior to cooking or season it with herbs on the stove or in the oven. You can use a store-bought marinade or make your own using oil, your choice of herbs and citrus juice (lemon, lime or orange) or soy sauce. If you don't have time to marinate, simply brush your fish with oil and sprinkle it with herbs.

If you're counting calories or watching your fat intake, substitute low-fat or reduced-calorie versions of binding ingredients such as mayonnaise or sour cream in seafood salads. You won't detect any difference in flavor once the other ingredients are added.

Season your seafood salad with celery, green pepper, onion, garlic, pickle or a variety of herbs. Or stir in a few drops of lemon juice, Worcestershire sauce, hot sauce or tamari (an aged soy sauce prepared with little or no wheat). Taste as you mix to arrive at a balance of flavors pleasing to your palate.

When serving, make sure your seafood salad looks as good as it tastes. For a color contrast, mound it on a lush bed of greenery — green or red leaf lettuce, romaine, spinach, endive or arugula. Or stuff the salad into a buttery, ripe avocado half or a bright red tomato cut into eighths (stop the cuts about 1/2 inch from the bottom of the tomato so that it holds together like the petals of a flower). For something a little different, pile your salad atop sliced rounds of raw yellow squash, zucchini or cucumbers or over chilled, cooked asparagus spears.

With such a showy presentation, you can offer seafood salads to guests at luncheons, parties and picnics. If served outdoors, be sure salads are consumed quickly and not left on tables in the heat to spoil.

Seafood salads can be food for the family too. Since they're usually made ahead of time, they offer a quick, easy way to put a meal on the table in minutes.

Flaked Fish and Macaroni Salad

- 1 1/2 cups flaked fish
- 4 ounces macaroni
- 1/2 cup chopped celery
- 1/4 cup chopped onion
- 3 tablespoons finely chopped green pepper
- 1 8.5-ounce can green peas, drained
- 1 small jar chopped pimento, drained
- 1 hard-boiled egg, chopped (optional)
- 1/2 cup reduced-calorie mayonnaise
- 1/4 teaspoon salt
- 1/2 teaspoon celery seed
- 1/4 teaspoon freshly ground black pepper
- lettuce leaves
- paprika
- 16 to 20 cherry tomatoes

Cook macaroni according to package directions. Drain. Rinse with cold water. Separate any pieces that stick together. Meanwhile, chop celery, onion and green pepper.

In a large bowl, combine macaroni, celery, onion and green pepper. Stir in peas and pimento. Add fish. Mix gently but thoroughly.

Place mayonnaise in a measuring cup. Stir in salt, celery seed and black pepper. Add to fish mixture and mix well. Chill thoroughly. Arrange on lettuce leaves. Sprinkle with paprika. Garnish with cherry tomatoes. Serves 8 to 10.

Seafood-Stuffed Avocados

- 1/2 pound backfin crabmeat
- 1/2 pound cooked small shrimp, peeled and deveined
- 3 tablespoons reduced-calorie mayonnaise
- 3 tablespoons light sour cream
- 1/4 teaspoon salt
- 1/4 teaspoon freshly ground white pepper
- 3 avocados, chilled
- paprika

Carefully remove any shell from crabmeat. In medium bowl, combine crabmeat and shrimp. Add mayonnaise, sour cream, salt and pepper. Mix gently but thoroughly. Chill for several hours.

When ready to serve, cut avocados in half lengthwise. Remove the pit but do not peel. Mound centers with salad. Sprinkle with paprika. Serves 6.

Shrimp and Dill Salad

- 1 1/2 pounds small shrimp
- 1 1/2 cups water
- 1/2 teaspoon chopped garlic
- 1/2 teaspoon celery seeds
- 1/4 teaspoon cayenne pepper
- 1/2 cup chopped celery
- 1/2 cup reduced-calorie mayonnaise
- 1/4 teaspoon freshly ground white pepper
- 4 teaspoons chopped fresh dill weed
- lettuce leaves
- lemon wedges

Bring water, garlic, celery seeds and cayenne to boil in medium saucepan. Reduce heat and simmer for 10 minutes. Bring back to boil and add shrimp. When liquid returns to boil, stir and cook until shrimp are pink, about 2 to 3 minutes. Drain in a colander.

Place shrimp in a medium bowl. Add celery, mayonnaise, pepper and dill; mix thoroughly. Chill well. Serve on lettuce with lemon wedges. Serves 6.

Fresh Fish Salad

- 2 cups cooked, flaked fish
- 1/2 cup chopped celery
- 1 8.5-ounce can green peas, drained
- 2 tablespoons chopped sweet pickle
- 2 tablespoons chopped onion
- 2 hard-boiled eggs, diced
- 1/2 cup reduced-calorie mayonnaise
- 1/2 teaspoon salt
- 1/4 teaspoon freshly ground black pepper
- 1 teaspoon fresh lemon juice
- 6 tomatoes

Combine fish, celery, peas, pickle, onion, eggs, mayonnaise, salt, pepper and lemon juice in a medium bowl. Toss lightly until well mixed. Chill for several hours or overnight. Cut tomatoes into eighths without cutting through and pull open. Pack salad into each tomato. Serves 6.

Crab Salad Deluxe

- 1 pound lump or backfin crabmeat
- 1 1/2 cups chopped celery
- 1/4 cup chopped onion
- 2 tablespoons finely chopped green pepper
- 1/3 cup finely chopped fresh parsley
- 4 teaspoons fresh lemon juice
- 1/2 cup reduced-calorie mayonnaise

Carefully remove any shell from crabmeat. In a medium bowl, combine celery, onion, green pepper and parsley. Add crabmeat. Stir in lemon juice and mayonnaise. Mix gently but well. Avoid breaking up crabmeat. Chill for several hours. Serves 6. ▣

All recipes were developed by Joyce Taylor and the Carteret County Nutrition Leaders at the North Carolina State University Seafood Laboratory in Morehead City.

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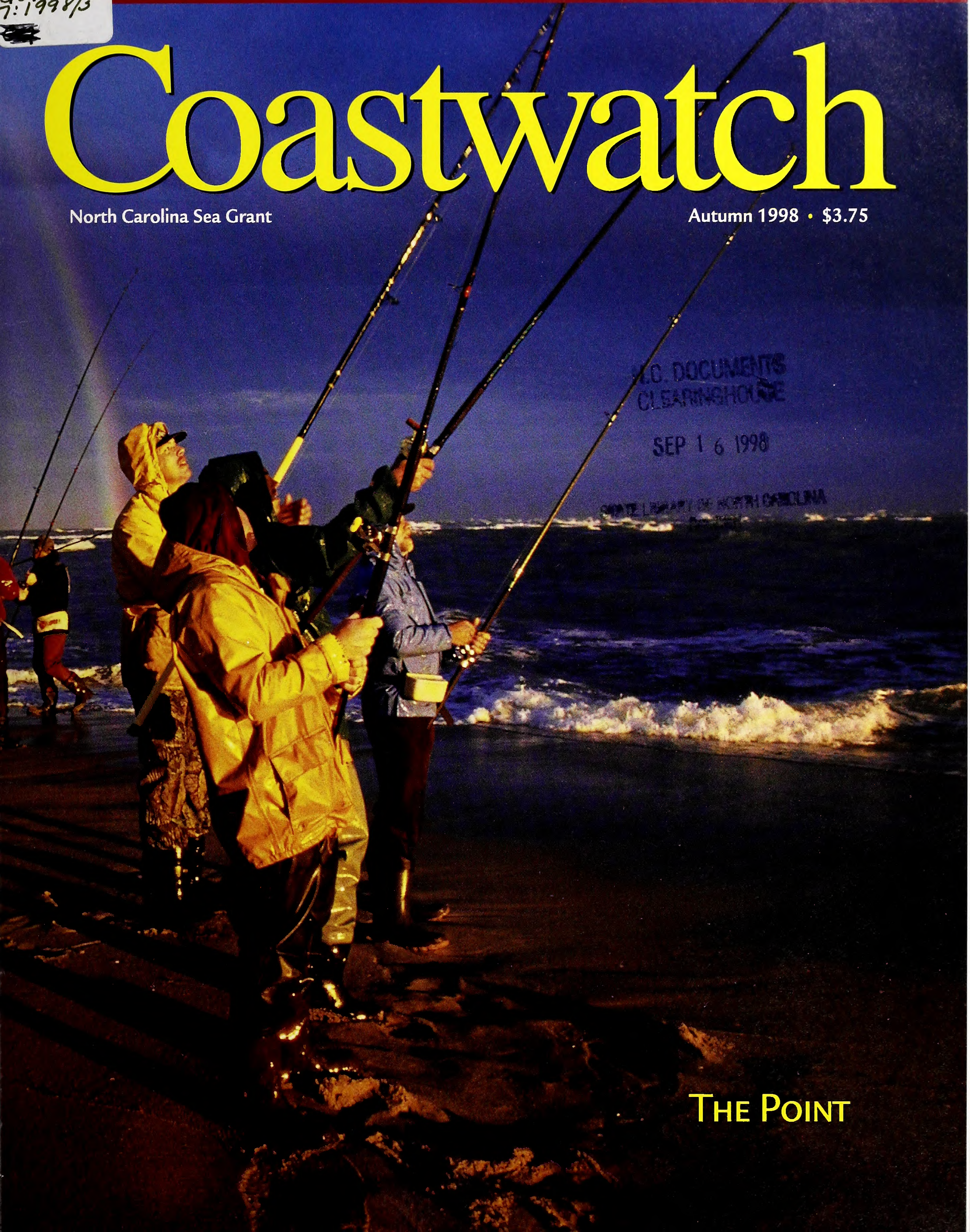

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THE POINT

From the Editors

Lifelong Learning

Summer closes quietly in late September. In its place arrive autumn and a return to responsibility. Cooler, shorter days correspond with a return to class for kids and young adults, the end of leisurely days and escapes to the beach. We all seem to head back to business.

These changes in season and sentiment have us thinking about education and Sea Grant's role in teaching people of all ages about marine and coastal issues. Many of us associate books and tests with education, but maybe we should widen our vision of learning and its place in our lives.

Perhaps we should engage in learning year-round and life-long.

The Sea Grant Extension Program reaches out to people of varied backgrounds to help them learn something that enriches their work or their lives. In that way, the agents and specialists are hands-on educators. They ask questions and seek out the best ways to communicate new information about the coast, coastal living and coastal livelihoods.

Years of work in the field and careful research support this information.

And what is research but the most basic type of education? Asking a question and finding an answer — that's what science is about. Researchers can invest years and careers in their education on a single issue. The search for an answer to one question invites another question and so on until a pattern of findings emerges. For examples of how this works, see Debbi Sykes Braswell's story on how long-term Sea Grant-funded research has provided an education for biologists, business owners and the state of North Carolina.

As editors of *Coastwatch*, we also feel responsible for educating readers through the stories we choose for the magazine. For each issue, our writers become students, learning about topics that pique their interest. They pass on what they learn in their articles.

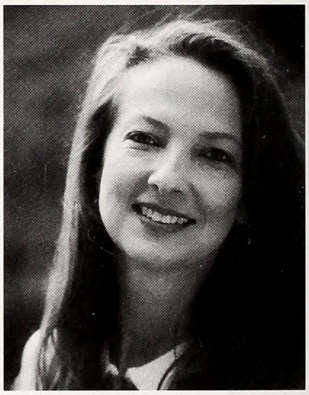
In the latest installment of The Coast series, T. Edward Nickens takes a lesson from recreational fishers at Cape Hatteras. For them, surf fishing is not merely a casual afternoon spent casting a line into the ocean; it's a way of being, a philosophy of life. The folks who are best at this sport understand the fish, their biology, the reasons for their behavior, how they run in certain weather. It's not pure luck.

Daun Daemon asks how navigators can look at the stars and find their way around our planet's vast oceans. She discovers that celestial navigation is more than simply gazing heavenward. Her source takes her back to school in mathematics and trigonometry.

Jeannie Norris meets with Sea Grant agent Spencer Rogers for a lesson in physics. He explains what homeowners need to know about the forces of uplift and how they can wreck an unprotected building. And it wouldn't be a complete lesson without instruction on how to prevent this type of damage.

We hope that these stories, and the others in this issue of *Coastwatch*, will teach you something — or spark an interest in learning something new. You can't catch the latest on the Carolina coast unless you first cast for it. ◘

Jeannie Norris



Daun Daemon

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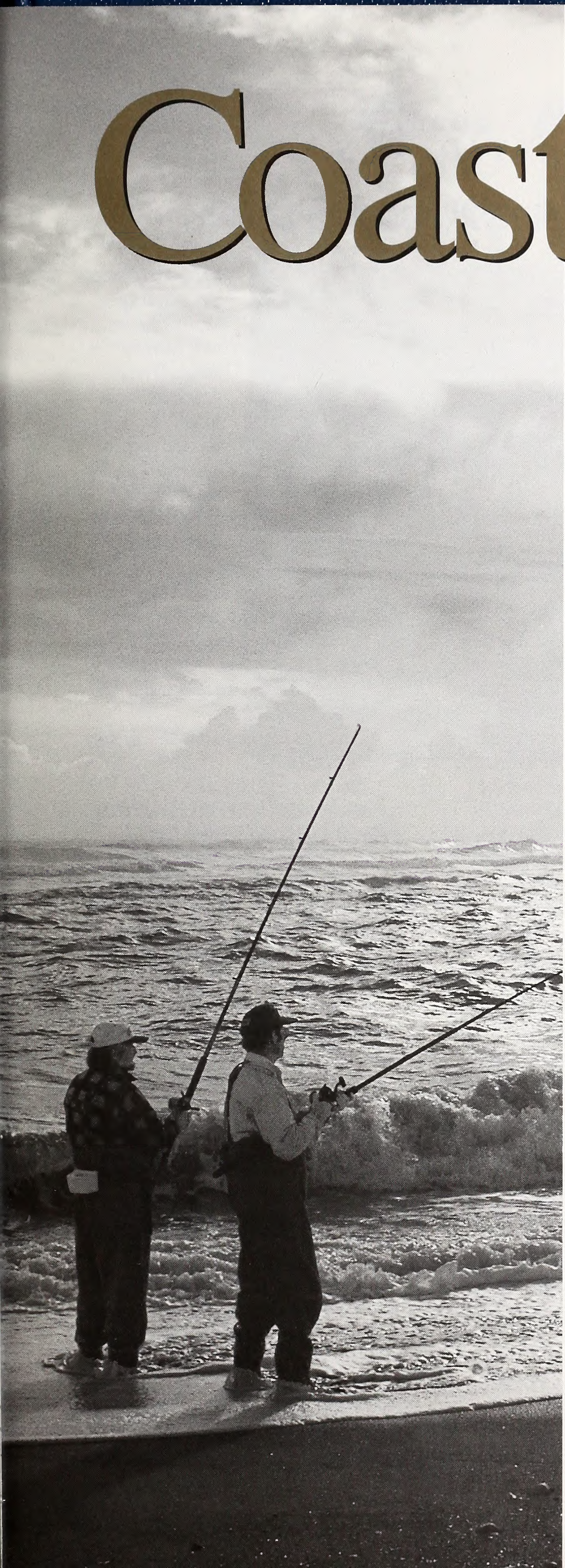
Coastwatch



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The Point
It's no wonder that hundreds of fishers squeeze shoulder to shoulder at Cape Hatteras every autumn. For decades, folks have cast for a bounty of fish from two hemispheres, which the Gulf Stream and a Labrador Current sweep past this crook of sand. Some fishers at "the Point" drive new sport utility vehicles. Others arrive in old trucks. All love to fish. 6

Setting Sights on the Stars
In today's electronic age, navigating is as easy as punching a couple of buttons on a handy device. But machines can break. That's when it's time to look skyward for help — and let celestial bodies guide you to your destination. 14

Taking the Long View: Research Reaps Results in Time
Science is not for the impatient or the shortsighted. Several Sea Grant researchers face challenges as they spend years studying hybrid striped bass, the Neuse River and marine habitats. But the results are worth the wait. 18

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The Outer Banks is the place for striped bass fishing this fall. The popular sport fish is just a cast away in the surf, but its population hasn't always been as healthy as it is today. 28

Sea Science: **Weathering Winds and Water — Steps for a Storm-Resistant Home**
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Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for $15 by the North Carolina Sea Grant College Program, Box 8605, North Carolina State University, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: faris @unity.ncsu.edu or ddaemon@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover and table of contents photos of "the Point" at Cape Hatteras by Scott D. Taylor.

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COASTAL
TIDINGS

Wings Over Water

Eastern North Carolina is a naturalist's paradise, and the bird-watchers who travel there do more than identify birds with their binoculars — they stay in hotels, eat at restaurants, go shopping and visit tourist attractions.

This fall, when bird-watchers from around the country converge on the coast for the *Wings Over Water Festival* Nov. 6-8, Sea Grant's Jack Thigpen will be there to study them and their habits. Thigpen, a coastal tourism and recreation specialist in Nags Head, will survey the folks attending the event to find out who they are and how they spend their money while in the area.

A common misconception about birders is that they are wealthy fanatics with deep-seated desires to add to their life lists. But studies show that this type of birder comprises only a small percentage of bird-watchers. Many simply enjoy viewing birds in their natural habitats.

And no matter who they are, they spend money to pursue their hobby. Some estimates indicate that birders pump billions of dollars into the national economy. The impact on local economies can be significant as well. Once communities and businesses understand the kinds of birders who visit their areas and how they spend their money, they can develop more effective marketing strategies, Thigpen says. His study of the participants in *Wings Over Water* is intended to help coastal businesses do just that.

"This information will be useful for planning and marketing next year's event and will demonstrate the economic impact of birders," Thigpen says. "And other communities will find the information useful as well."

Watch for Thigpen's results in a future issue of *Coastwatch.*

The event-packed festival — sponsored by the Dare County Tourist Board, U.S. Fish and Wildlife Service, Coastal Wildlife Refuge Society and the Outer Banks Chamber of Commerce — will include more than 100 workshops, field trips and seminars. Participants can take a ferry to Ocracoke Island, climb Jockey's Ridge, canoe a salt marsh and more. For registration information, contact the Dare County Tourist Bureau at 1-800/446-6262 or send e-mail to dctb-info@outer-banks.com. ◘ *— D.D.*

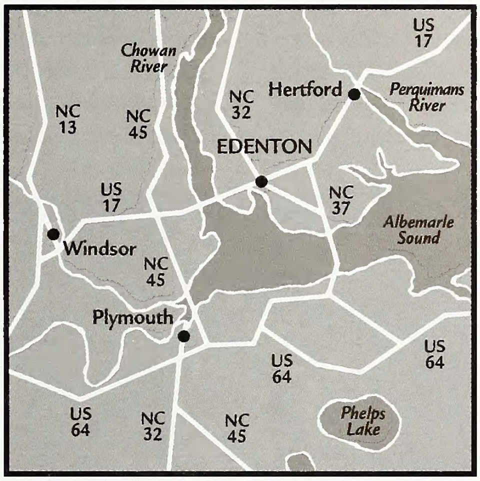
In the Next Issue of *Coastwatch*

Last December, the Food and Drug Administration began enforcing a seafood safety regulation designed to protect the nation's supply of shrimp, crabs, fish and other coastal favorites. How have North Carolina processors and dealers fared under this regulation? Debbi Sykes Braswell investigates.

Also, Wilmington resident Rowan LeCompte takes stained glass art to new heights. He talks to Odile Fredericks about his creations, which can be found from coastal North Carolina to the Washington National Cathedral.

Finally, Julie Ann Powers visits Feather Phillips at Pocosin Arts, an educational organization that connects culture to the environment through native art. ◘

Sound Country Celebration at Edenton



Celebrate the natural and cultural resources of the Albemarle area with the first Sound Country Celebration in Edenton Nov. 14-15. More than a good time, this festival raises money to protect the region's ecologically significant lands and to support small businesses engaged in eco-tourism.

The celebration will feature canoe and kayak races sponsored by North Carolina's Canoe Racing Association (anybody can enter), demonstrations by paddle-powered watercraft, regional arts and crafts, interpretive canoe outings, raffles, daylong music, educational booths, food vendors and contests.

Activities Nov. 14 will concentrate along the Edenton waterfront with guided canoe and kayak outings on Pembroke Creek, Queen Ann Creek and Bennetts Millpond. The Nov. 15 activities include outings on Bennetts Millpond and demonstrations of "old-timey" farm equipment at the Albemarle Recreation Center.

The event is sponsored by the N.C. Coastal Waters Heritage Council, the town of Edenton, Chowan County, N.C. Division of Parks & Recreation, Trestle House Inn, Albemarle Recreation Center, Albemarle Resource Conservation and Development, Chowan/Edenton Chamber of Commerce and Pro-Canoe of Raleigh.

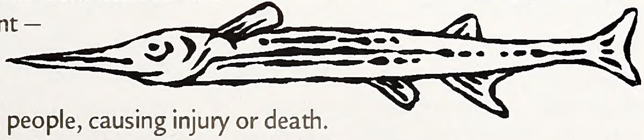
For information, call Nancy Nicholls at 1-800/775-0111, Peter L. Bogus at 252/482-2282 or Rodney Johnson at 252/482-7437. ▫ —*J.F.N.*

En Garde!

Like skinny torpedoes, needlefish race through the water in search of dinner. Their long beaks and tiny, razor-sharp teeth are perfect for snatching small fish.

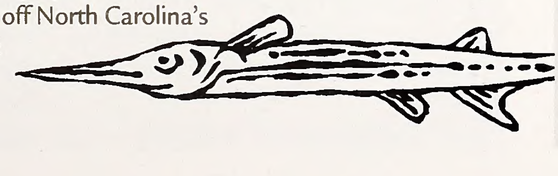
These surface-dwellers range from about 2 feet to more than 4 feet long. Their fins are set far back on their bodies, and they sport a lateral line from head to tail.

They are magnificent — and dangerous — jumpers. On occasion, needlefish have impaled people, causing injury or death.



Three species inhabit the waters off North Carolina's coast: the flat needlefish, the Atlantic needlefish and the houndfish. ▫

— *D.D.*



Fishery Resource Grants Awarded

The state has awarded more than $743,000 in research grants that will allow people who are interested in fishery resources to test their ideas about improving those resources.

Twenty of the 53 proposals were funded. Altogether, the applicants requested more than $2 million.

The Fishery Resource Grant Program is based on the premise that people who are involved in fishery resources have some of the best insight into how to improve the industry and the habitats. Grant recipients must be involved in commercial or recreational fishing, aquaculture or mariculture, or seafood handling, or they must have endorsements from those industries and substantial involvement with them.

The program is funded by the North Carolina legislature and administered by North Carolina Sea Grant, which oversees the competitive application process. The state Marine Fisheries Commission makes the final funding decisions. This summer was the first time grants were awarded twice in one year. Earlier this year, $416,400 was awarded to 19 projects.

If the program is funded for 1999, the next opportunity to apply for a Fishery Resource Grant will come this fall. For information, call Sea Grant at 919/515-2454. ▫ — *D.S.B.*

Getting Hooked on Carteret County Fishing

Want to know whether the puppy drum or speckled trout are biting in Carteret County?

Now the answer is a toll-free call away.

The newly formed Cape Lookout Sportfishing Association has started a fishing report hotline that lets callers get up-to-the-minute, all-day information about saltwater fishing in the area. It gives sound, pier, inshore and blue water reports. To access it, dial 800/251-1442 or 223-1442 in Carteret County. You can also order a free color brochure on fishing in Carteret County at that number.

The Cape Lookout Sportfishing Association aims to promote the Carteret County business community year-round through all types of recreational fishing. ◘ *— D.S.B.*

Wanted: Sunken Living Room; No Skylight Needed

On the ocean floor, shipwrecks often turn into prime real estate.

Marine life gradually moves into these underwater condos, attracted by the honeycomb of places to hide from predators. The smaller creatures attract larger creatures, which attract still larger creatures, and soon there's an entire neighborhood.

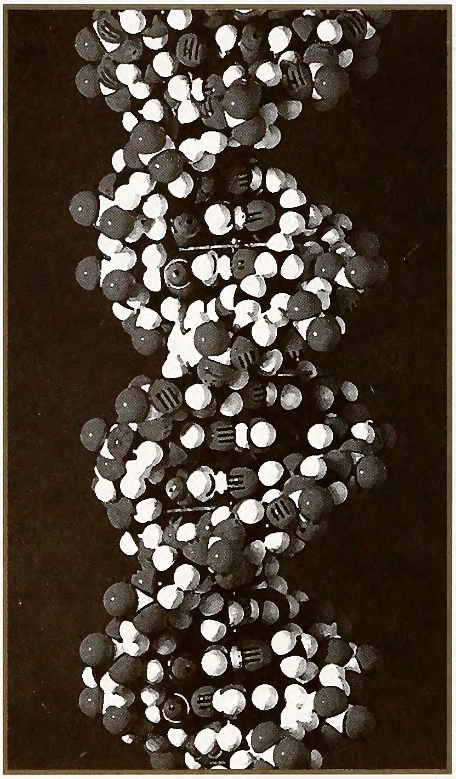
And beautifying everything, a coating of anemones and corals takes shape over the wreck.

So, location, location, location might be the maxim on land. But opportunity is what counts underwater. ◘ *— D.S.B.*

Around the Sea Grant Network:

Fish Gene Shows Promise in Animal Genetic Engineering, Human Gene Therapy

A gene that stopped functioning millions of years ago in ancestors of the salmon family is now awake. Minnesota Sea Grant scientists have converted the gene, called a transposon, into a new DNA delivery system that can be used to transport normal genes into genetically damaged cells that cause such illnesses as hemophilia or cancer. The discovery was based on Minnesota Sea Grant researcher Perry Hackett's work to genetically engineer faster-growing fish for aquaculture.



In an attempt to develop a better way to move engineered genes into the chromosomes of fish cells, Hackett and his colleagues Zsuzsanna Izvák and Zoltán Ivics began studying transposons. They could not find an active transposon gene in modern fish. But their research did indicate that Atlantic salmon and rainbow trout had an inactive transposon that stopped functioning more than 10 million years ago due to mutations. They resurrected and rebuilt the transposon, removing the mutations.

In laboratory culture dishes, the transposon carried new gene sequences past natural barriers into the nucleus of human, zebrafish and mouse cells and inserted them into the DNA. Izvák named the transposon system "Sleeping Beauty." Hackett sees it as a tool that could be used for many purposes. Already, a number of companies are interested in buying rights to use the process in agriculture, pharmaceuticals and biotherapy.

Most human gene therapy developments have relied on viruses, which are modified to become harmless while they deliver new genes to cells. However, some researchers fear that the inactive viruses could combine to create a dangerous hybrid. Hackett's development may match the viruses' efficiency in inserting chromosomes without presenting the potential hazards. Another major application of the technology, says Hackett, may be gene discovery. "This technique can be used to find new genes never identified before as well as to define new roles of previously known genes that are important for the growth, development and health of vertebrate animals," he says. ◘

AROUND THE SEA GRANT NETWORK:

Aerators Minimize Marina Fish Kills

In the thick of a hot Texas summer, Sea Grant researchers discovered that aerators could add enough oxygen to marina basins to improve water quality and decrease the potential for fish kills.

"The aerators provided marina operators with a simple solution to an often smelly and expensive problem," says Dewayne Hollin, Texas Sea Grant marine business management specialist.

Texas Sea Grant sponsored the project in 1997 with the help of several marinas in the Clear Lake/Galveston Bay area. Marina personnel were briefed on why fish kills occur and were trained to use a dissolved oxygen (DO) meter. Marina operators took several DO readings per week at various times and locations, using the aerators when DO levels dropped or they saw fish on the water's surface.

While many marina operators reported conditions conducive to fish kills, the aerators alleviated the problem and no fish kills were reported. Fishing also improved in the marina basin while the aerators operated.

"The use of aerators gives marinas an 'insurance policy' and an effective tool to deal with low DO levels in these circulation-restricted areas of their basins," Hollin says. "It is not the final solution to the water quality problem, but it is an excellent preventative measure for fish kills and maintenance of better water quality."

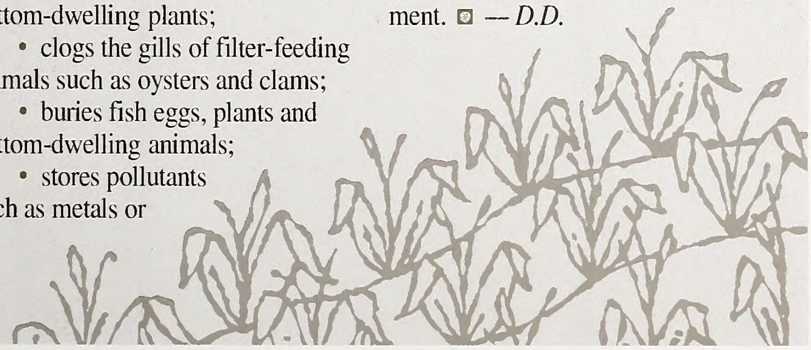
Summertime conditions in Texas this year favored oxygen depletion and fish kills as temperatures soared and winds diminished. As of mid-August, marinas using the aeration devices covered in the demonstration project reported no fish kills, even in basins with poor circulation. The weather had caused several fish kills along the coast at other marinas, Hollin says. ▣

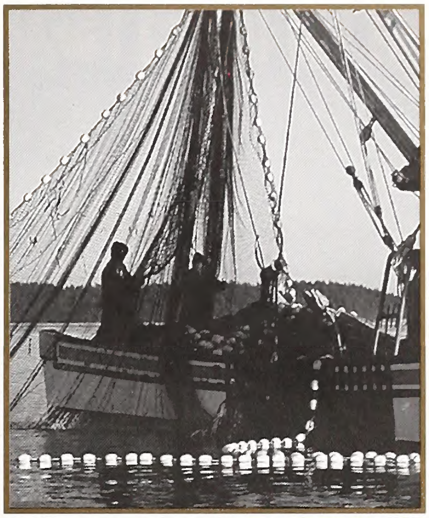
The Dirt on Sediment

Water pollution is not just toxins and trash. Sediment, tiny particles of soil introduced into water, is considered a pollutant if it:

- remains suspended in water and prevents light penetration, thus reducing the photosynthesis of bottom-dwelling plants;
- clogs the gills of filter-feeding animals such as oysters and clams;
- buries fish eggs, plants and bottom-dwelling animals;
- stores pollutants such as metals or nutrients and releases them into the water when the sediments are stirred up.

Sediment can enter aquatic habitats through runoff from activities on land, including farming, road construction and other development. ▣ — *D.D.*





Fishing Video

Fishers and others who want to learn more about bycatch reduction devices can get a free, private lesson in their homes.

The video *Commercial Fishing Gear and Bycatch Reduction Devices* highlights various commercial gear used in our coastal waters and the bycatch reduction devices associated with each type of gear.

"This video literally takes you onboard with the fishers who work our waters," says Bill Hitchcock, the video's producer. "We went out with the fishers and scientists and let them show, tell and demonstrate on location. The intent is to educate the public about the gear and how it works."

The video, which was funded by a Fishery Resource Grant, includes extensive underwater and aerial videography.

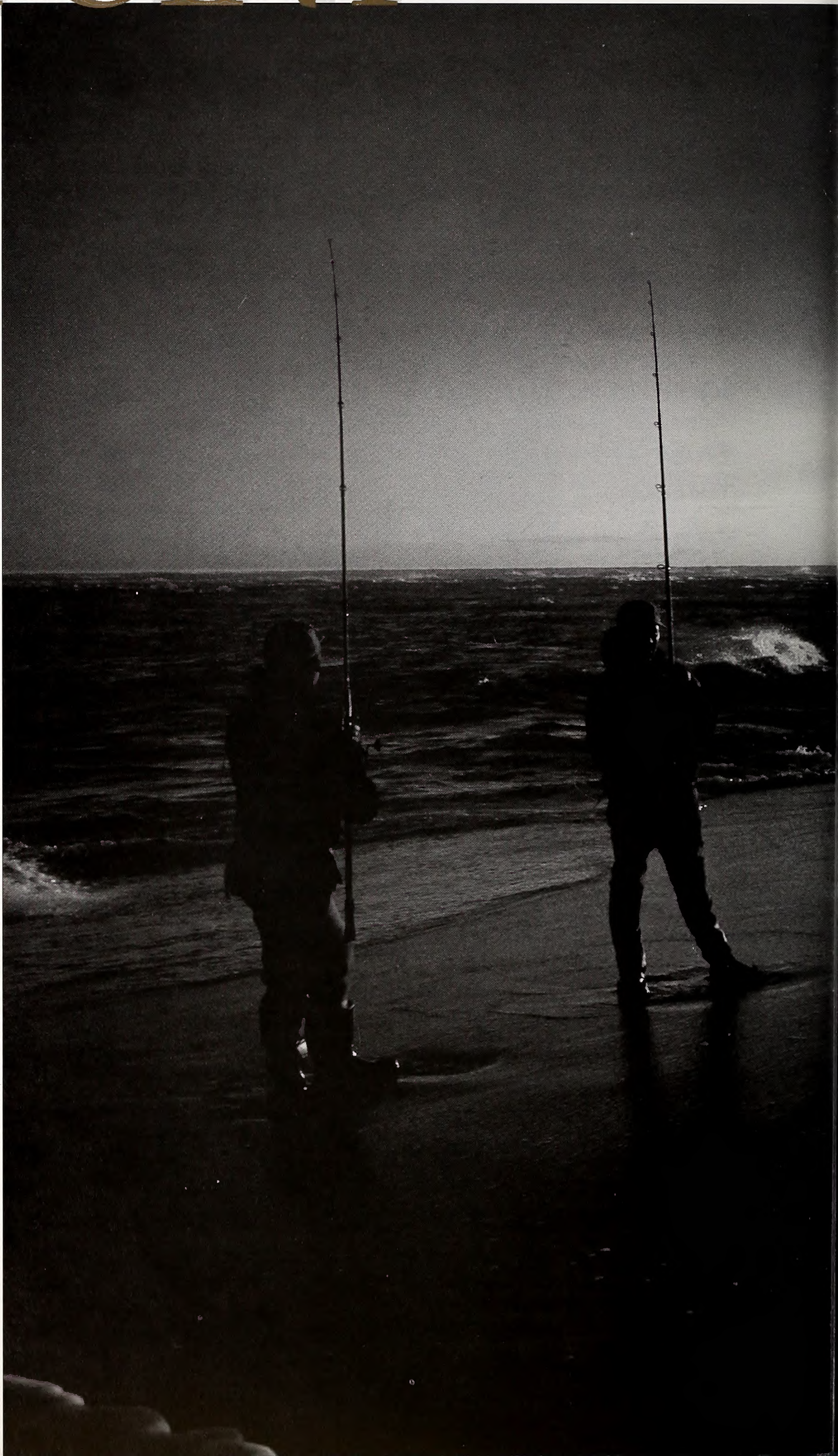
A limited number of the videos is available. To get a copy, send $5 for shipping and handling to Hitchcock Broadcasting, P.O. Box 1136, Newport, NC 28570.

Hitchcock plans to post the video on his World Wide Web site soon. Check it out at http://www.ncsaltwater.com. ▣ — *D.D.*

THE POINT

By T. Edward Nickens
Photos by Scott D. Taylor

AT CAPE HATTERAS, NOVEMBER IS NIRVANA FOR SURF FISHERS, WHOSE PILGRIMAGES ARE PART OF A DECADES-LONG TRADITION.



Standing on the edge of a continent, surf casters at Cape Hatteras have a fabled view of sunset over the Atlantic Ocean.

THE POINT AT CAPE HATTERAS IS A DEFIANT CHIN OF SAND THAT JUTS FAR INTO THE OCEAN, A WEDGE OF BEACH THAT SUCCUMBS TO THE SURF BUT PERSISTS SUBMERGED FOR 20 MILES IN A SHALLOWS DREADED BY MARINERS AND KNOWN AS DIAMOND SHOALS. To the south of those shoals, miles into the Atlantic, the Gulf Stream spins its clockwise current, pulling in warm water and warm-water fishes from equatorial regions north along the Atlantic Coast. Off Cape Hatteras, this river-in-an-ocean veers east, away from the continental verge, its impact on the weather of the mid-Atlantic and the fish of its waters diminishing as it is absorbed into the ocean.

At Cape Point, a few rare moments of relative solitude.
Anglers the world over leave tracks on these beaches, especially in the fall.

Meanwhile another great ocean river, the Labrador Current, circulates north of Hatteras, a counter-clockwise current that funnels colder water and its migrating denizens from the boreal Atlantic down the continent's northeastern coast.

Off the shore of Hatteras, eddies spin off of these two great ocean currents, meeting water from both hemispheres and fish from there also: red drum, speckled trout, bluefish and striped bass.

That is why the fishers are here.

Nowhere along the nation's shorelines is the culture of surf fishing so inextricably wound into the soul of a region as it is on the Cape Hatteras beaches, in particular at Cape Point in the cooling weeks of November. I have heard the stories all my life: When the great runs of red drum are in and the news is out, the trucks stack up three and five deep at "the Point," the fishers shoulder to shoulder and front to back, lines crossing in the air and water. There is laughter and shouting, cursing and fighting, and fish of impossible proportion brought to the beach.

In November along the north and south beaches, where ribbons of sand embrace the Point, currents push schools of glass minnows and menhaden against the shore, the shoaling waters and the sandbars, concentrating schools of bait and the pantheon of predatory fish that draws anglers to stand awash in the waves and hurl chunks of mullet, squid and shrimp off the edge of a continent.

I stand on that beach on a howling Thursday as the last gasp of a storm lashes the thin filament of Hatteras sand. I am there for the annual Cape Hatteras Anglers Club Invitational Surf Fishing Tournament, to ferret through Hatteras fishing lore and see how the finest surf anglers in the country approach their cryptic, consuming avocation. I tag along with a fishing team called Rising Tide, and I talk to old-timers about the nascent days of Hatteras surf fishing and cruise the crowded beach. If Cape Hatteras is, as the English writer Anthony Bailey observed, "fishing mad" during autumn, then it is downright batty during the first Thursday, Friday and Saturday of each November, when 100 six-person teams line the beaches of Cape Hatteras National Seashore. They come in spanking-new Suburbans and rusted-out Ford F150s from across the country and from the string of little villages — Frisco, Avon, Rodanthe and Buxton — that drape along the Outer Banks. I am there to watch, but, of course, I want to fish. I want to learn how to cast a piece of cut mullet far beyond the breakers, to know the difference between a red drum merely mouthing my bait and a flounder sucking it down, to know when it is best to use shrimp or squid or whether bloodworms or strips of bluefish are the wiser choice.

First I watch. I figure I might as well learn from the best.

“I'VE GOT A BOAT IN THE WATER THAT JUST SITS THERE,” PAT PRESTON TELLS ME, STANDING BAREFOOT ON DRY SAND JUST BEYOND REACH OF EACH WAVE'S SUCCESSIVE WASH ON THE SOUTH BEACH, A FEW HUNDRED YARDS FROM THE POINT. Preston is slender and bearded, and the nails of his hands are bloody from cutting mullet into strips for bait. He and five cronies are the Rising Tide, a team that has traveled the surf-fishing tournament circle for two decades. Each year they fish the four big North Carolina events — the Ocracoke Invitational in May, the “Little Hatteras” or Hatteras Village Civic Association Tournament in September, the Nags Head Surf Fishing Tournament in October and this, the “Big Hatteras,” in November. Preston has nothing against boats, and he will take to the water to catch a fish. But that is not his first love. “This is what I like,” he says, “the sand between your toes and you don't have to think about nothin'.”

A thicket of surf rods hints that something is happening off these Hatteras sands.

To those who do not fish from the sand — the sunbather, the shell-seeker, the walker of dogs and caretaker of children — surf fishing seems an inscrutable amusement: much ado about the thinking of nothing. All that water and a few little-bitty hooks. Standing for hour upon hour, rod in hand, belly out, feet sunk like old stumps in the sand. And then there's the infrastructure: pickup trucks bristling with rods the length of jousting lances and sagging with coolers and bait buckets and unshaven men. It seems an elaborate ruse designed to keep a person out of the house and away from useful activity, a fine excuse to drink beer, perhaps, or proof that a few folks have entirely too much time on their hands.

But I have fished enough elsewhere to know that what happens out there on the beach involves a kind of alchemy, a conspiracy of science, skill, long experience and luck that is largely invisible to the untutored. Preston might boast that he thinks about nothing, but that is because he has already thought about everything. The best surf fishers seek to cleanse each mote of chance, every speck of happenstance from the business at hand — how else can you explain gear of such quantity as to require a half-ton pickup truck to transport it? But all the while they fervently hope that luck will not abandon them altogether, for in the end it is often the final arbiter between fisher and fish.

Preston is 44 years old, lives in Nags Head and has fished for as long as he can remember. He landed his first fish when he was only 4 years old, but when I press for details he chuckles, then admits it was a freshwater eel. “My first saltwater fish was a sea mullet,” he says, as if the others were barely memorable and certainly didn't count.

At the time, Preston holds a 10 1/2-foot rod mated to a Penn 850 SS spinning reel loaded with 900 feet of line. He built the rod himself, he says, saving maybe $100 over the cost of a custom rod of similar quality. He reels in his bait to show how he fishes. The line from his rod and reel is tied to a bottom rig, a 2-foot length of monofilament with a large lead sinker attached to its terminus. Two 6-inch-long monofilament lines sprout from this main stem like branches on a tree, and each of those attaches to a yellow foam sphere, which serves as a visual attractant, and a stainless steel hook baited with a peach-pit-sized cut of mullet.

These bottom rigs come in various combinations of line materials and lengths, with or without attractor floats, and they are the surf fisher's basic artillery. Depending on how bottom rigs are outfitted, they can be used to catch red drum, flounder, striped bass, croaker, sea mullet, sand sharks, bluefish — just about any fish that swims the surf.

Continued

Preston skewers fresh chunks of mullet on his twinned hooks, walks swiftly to the water's edge, then launches the rig over the breakers. I watch the spiraling mass of lead, hook and bait cartwheel into the sky, losing it in the white glare above the horizon, then scan the water where I think it will land. The splash, which sounds like popcorn popping, is 40 feet farther than I expect.

For a long time I watch Preston fish, holding his rod with one hand, index finger curled around the gossamer line to feel the nudge or jolt of a take, and staring over the water as if by sheer force of will he could compel some fish toward his line. It seems a featureless stretch of beach — no sandy points jutting into the water to offer refuge from the current, no sandbars to funnel bait and hungry fish, none of what fishers call "structure" to attract and hold fish. All I see is the incessant roll and pitch of surf.

But Donnie Ross is catching a few, so I wander down the beach to where he leans against a Ford pickup truck flecked with rust, its bed a wild jumble of tackleboxes, waders, miscellaneous pails and boxes, and a wide cutting board covered with a skim of blood and fish slime. Ross wears battered khakis with the legs rolled up, and his bearded face peers from under a gray sweatshirt hood. I watch him cast, notice carefully where his spiraling rig of hooks, bait and sinker enter the water with a noisy splash, and I begin to see the structure he is fishing.

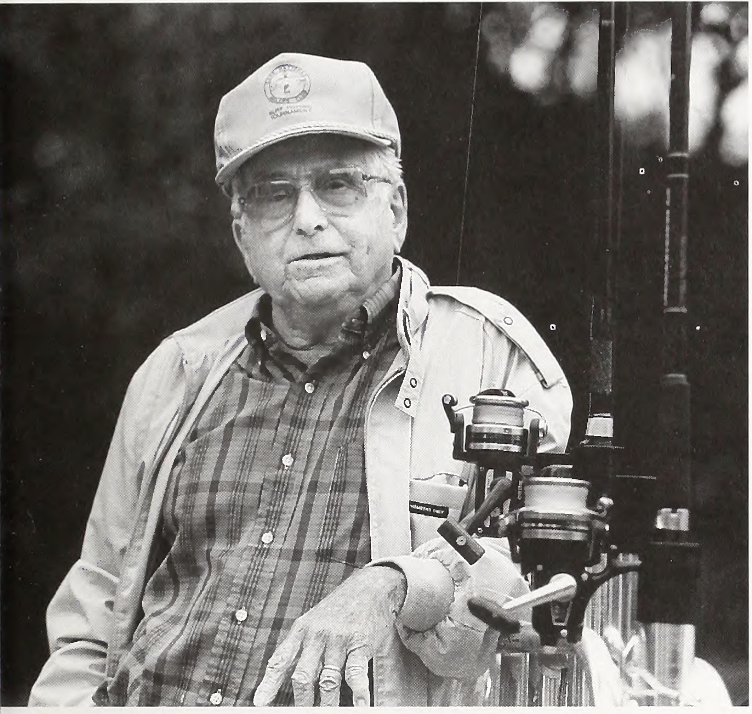
It is like letting my eyes adjust to darkness. At first there is nothing but the shapeless black, but after a few moments forms appear in the void, lines and patterns that slowly evolve detail. Just beyond the breakers, some 30 feet from shore, the brown water of the churning surf gives way to a broad swath of ever-so-slightly clearer water, a riverine seam with a greenish cast that flows another 30 feet wide before changing again to turbid seas. Ross casts to the back edge of that green seam, he tells me, on the theory that larger predatory fish cruise the transition zone, ambushing bait fish that wash out of the darker water or hold in the clear.

His gambit pays off — he catches bluefish after bluefish, small individuals, but some large enough to keep and therefore score in the tournament. In a few moments, most of the team members are shoulder to shoulder with Ross and one another, but only a few small fish oblige. It might be Hatteras and it might be November, but the fishing is slow and Rising Tide is fidgety. The fishers change the color of the bright wood attractors and floats called "doodlebugs" that festoon their bottom rigs, switching from red to white to chartreuse and back again; they try lighter rods, switch sinkers and hooks, baits and floats.

The esoterica of surf fishing has always been baffling, mystical in its intricacy. I can hold the long rods and gleaming gold reels in my hands and comprehend their array of gears and spools and handles. But when it comes to all of the wire leaders and oddly shaped hooks and brightly colored balls and bobs, theirs is work unseen, out there under the swell and crash and foam, and an alien language to me.

Consider sinkers, the lead weights that at first blush appear the most prosaic of the surf fisher's armament. When Bob Shook pulls in two young red drum, called "puppy drum," on back-to-back casts, I walk over to see what he is doing that others aren't. Right away I notice that his sinker, a round coin of lead, is shaped unlike any I've seen before. The quiet man's eyes twinkle for a moment, in instant comprehension of the depth of my query. "You could write a book on sinkers," Shook says.

The angler's armament: Sure, you can catch fish with just a rod and reel. But why would you want to?



Edgar Hooper remembers the handlines, the Penn Squidder reels, the Model-A Fords half-buried in the sand and the stretches of deserted beaches, even in fall.

"Think about it," he instructs. A round weight such as his allows the bait to roll along the surf bottom, fluttering like a live fish. And a round sinker is easier to snatch off the bottom for a quicker hook-set, critical to soft-biting fish.

Shook digs through a camouflaged bag overflowing with lead sinkers. In addition to coin and pyramid sinkers, he says, there are storm sinkers, egg sinkers, bank sinkers and bombers, also called satellites, breakaways or Sputniks. He pulls out a wedge of lead with a concave, broad head. Locals call it a frog's tongue or arrowhead, he says, and it's particularly suited for Hatteras waters. Strong side-currents push the sinker over, driving the blunt head into the sand for a strong hold.

"But there's a lot of fishermen who don't know about all that stuff," Shook says, his cigarette pinched in a grin. "And they fish right beside you and catch the big one."

How they do that is a question I want to pose to Preston, but one I fear might be construed as cynical or contemptuous or at the least sophomoric. But then the tournament judge shows up and tells Preston about a few 15-inch bluefish caught on "metal," an artificial lure, most likely a Hopkins spoon. Preston shakes his head and looks up the beach. He knows who the judge is talking about.

"Those Jersey guys," he says, a bit wearily. "Man, they will throw the metal. But dad-gone, I hate to get so tired out so early."

It gives me an opening to make my pitch: Taking into account the thousands of dollars of gear owned by the team, what does he make of the role of luck in the angler's game?

He thinks for a moment, eyes fixed on the dime-sized spot of the Atlantic Ocean where his thin line disappears in the surf, and begins to grin.

"I guess it's like my friend Ted Mosely says," he replies. "You can't worry about the mule going blind, you just keep loading the wagon. All we can do is fish and hope."

Fishing and hoping have gone hand in hand at Hatteras for decades, and there is history enough of huge fish caught from its beaches to keep the hope at fever pitch. Some years, swarms of 15- and 20-pound bluefish blitz the Hatteras beaches, driving thousands of bait fish onto the sand as the great schools cruise the sloughs. Striped bass in excess of 25 pounds are once again becoming a more common occurrence, while dreams of another mammoth red drum — like the world record 94-pound 2-ounce beast caught on the Avon beach in 1984 — keep the most obdurate anglers on the beach night after night, all night long.

That afternoon I leave Rising Tide on the south beach, its members lagging far behind the tournament leaders, to visit Edgar Hooper, a Hatteras Island resident since 1946 and frequent visitor for 30 years before that. A five-time president of the Cape Hatteras Anglers Club, Hooper remembers fishing with a handline in the 1920s, whirling the weighted end of a cotton line around his head like David's sling. "Swing it around and let it ride," he says, sitting in the kitchen of his house, the dining table a jumble of old Penn Squidder and Surfmaster reels. "You got a drum on, well, you throwed the line up over your shoulder and go on with it, just drug 'im out." The first time Hooper saw conventional spinning tackle, he scoffed at the contraption. "I said, what the hell would I want with that? It was just an old coffee grinder as far as I could tell."

According to Hooper, not until the 1940s did locals begin using the newfangled surf-fishing rods and reels already popular along the New Jersey coast and elsewhere. But a decade prior to that, the cape's reputation for surf fishing was sufficiently royal to entice northern anglers to endure a bone-bruising journey to the Point. In his *Atlantic Game Fishing*, published in 1937 with an introduction by Ernest Hemingway, S. Kip Farrington Jr. outlines the trip in the years long before Bonner Bridge spanned Oregon Inlet: "From New York, the ships of the Eastern Steamship Lines sail daily, except Sunday, reach Norfolk at eight o'clock in the morning, connecting with the bus which leaves at eight-thirty ... . Your destination, by bus, is the 'Whalebone Filling Station,' in the village of Wancheese [sic], a trip of about two and a half hours. There, it is necessary to have a car meet you from Hatteras, which will come upon receipt of a telegram. After a ten-mile drive, Oregon Inlet is crossed by ferry. Cape Hatteras is fifty-five miles down the beach by car from Oregon Inlet."

Continued

After such a trip, it is a wonder that anyone retained the energy to cast lines of braided linen with rods of bamboo, lancewood, greenheart and even hickory. But cast they did. Hooper tells me about driving to the Point in Model-A Fords, tires slack for traction, and fishing with linen lines that had to be wound around a large wooden wheel after each use to dry. The old reels were bulky and difficult to use because the spools had no drag mechanisms to slow their spin when a fish surged. Anglers used leather gloves and surgeon's plaster to keep from burning their thumbs when fighting a large fish.

Contemporary readers of these early fishing tomes will recognize the pound of pulse and surf described in unself-consciously extravagant language. "To feel the lift, the gentle mouthing, and then the irresistible tug and run of a thirty-pound channel bass ...," such was the allure of surf fishing, intones Van Campen Heilner and Frank Stick in *The Call of the Surf*, a splendid book published in 1924 and considered the first on American surf fishing. "At the end of the line may be a fighting demon of the deep which no linen ever twisted is strong enough to halt, and one can but grasp the straining rod and pray that his antagonist may turn before the thousand feet of line is exhausted." Packed with breathless prose about the runs of red drum, "the coppery comet's rush," *The Call of the Surf* also contains a glimpse of surf fishing's increasingly technical future. "The systems of our father's time are now quite passé," the authors write, "and quite likely present-day ideas will be scorned by the next generation."

I leave Hooper and his memories of how things used to be and call on a Hatteras surf-fishing legend. Zander Brody is 43 years old, with wrists freckled by the sun and a small blue tattoo on his right ring finger. When those hands are wrapped around a 13 1/2-foot-long surf rod, Brody can heave 5 1/2 ounces of lead more than 600 feet. That is twice the length of a football field, and while it was an impressive enough cast to win Brody title as North Carolina distance-casting champion six years in a row, it is still shy of the best in the world. English casters can lob their metal an astonishing 800 feet and more.

The Cape Hatteras lighthouse has been there for it all, from the days when fishers arrived via steamer line to the caravans of four-wheel-drives, whose tire tracks score the beach today.

Within moments of sliding into his weathered Jeep Waggoneer, Brody tells me that he is "a fanatic about distance." When Brody talks, his bottom row of teeth flashes in a way that brings to mind a bulldog, which is not surprising, for his are brash, scurrilous opinions delivered with a grin. "Oh yeah, you can fish where other people can't," he explains. "One time a guy asked me, 'Man, just how far are you fishing out?' And I said, 'In a different ocean than you, bub.'

"And I was."

At the time, Brody isn't fishing in any ocean — the flu kept him out of the tournament, but he isn't so stricken that he can't steer down the beach to Cape Point. I sit in a passenger seat awash with the detritus of the avid surf fisher: Within reach are a can of bug spray, wool socks, binoculars, flashlight, drink cups, fishing lures loose and still in their plastic wrap, a bottle of Windex to clear salt spray from the windshield, an ashtray overflowing with cigarette butts, a spool of 40-pound-test monofilament fishing line the size of a toilet paper roll, candy wrappers, coffee filters, hooks, a sizable haul of sand and five pairs of sunglasses in various states of disrepair.

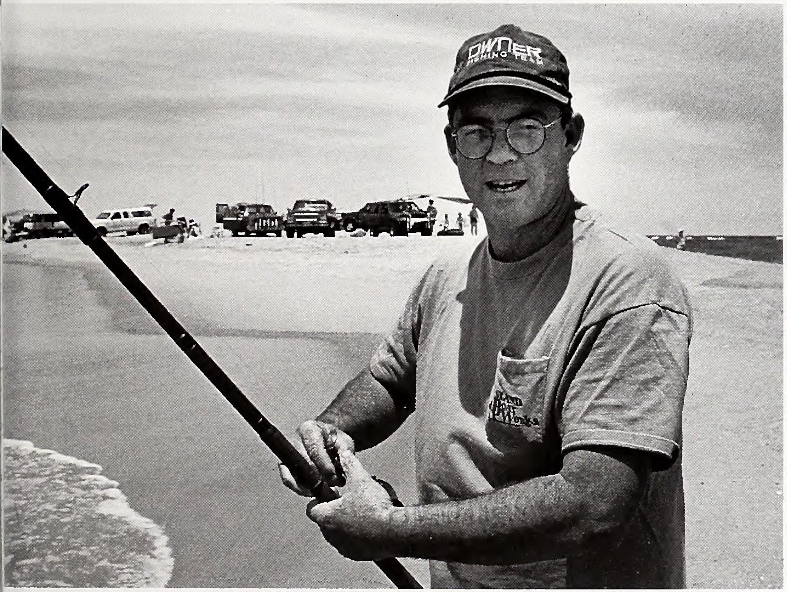
According to Brody, the Hatteras beaches used to be the tramping ground for surf-fishing addicts and eccentrics. "The people that came here, they came to fish," he says, stopping to eye a slough in the surf where terns wheel above a school of bait fish. "Now, it's trendy. Now you can take your Suburban, your mixed drinks. You've got radios blaring, car doors slamming. You've got your gadget show-boys with all the toys. I don't know how much it is about catching fish anymore."

Used to be, he says, you paid your

dues through accumulated knowledge. Now, you simply pay your dues.

Right then Brody nods toward a gleaming new Suburban some distance up the beach. "There's a show-boy," he says, with a disgusted spit. "Fifty thousand dollars worth of gear and he'll wait till (someone) like me catches a fish, and then he'll get in my waders."

That kind of behavior breeds a common complaint among Hatteras regulars. But as we slowly drive the beaches, I see plenty of fishers leaning against ragged old trucks, delivery vans crammed full of sleeping bunks and four-wheel-drive vehicles emblazoned with the names and telephone numbers of plumbers and carpenters and glass cutters. If anything, its plebian appeal, predicated on access to anyone with a pickup truck, is surf fishing's saving grace. The act of casting meat or metal into the ocean has yet to be cannibalized by commercialism.



Long-distance caster and common man Zander Brody shares the beach with out-of-towners, but he wonders how many of them are in it for the fish.

"It's the only thing left where there's no money, you know?" Brody explains. By that he means there is little money to be won by surf fishing, for the surf-fishing tournaments offer prizes such as gear and tackle but not the $50,000 jackpots of other tournaments. "Mackerel fishing, marlin fishing — it's all about the money now. Surf fishing's not like that. At least not yet."

ANYONE WHO LOVES TO FISH AS MUCH AS I DO CAN ONLY WATCH OTHER PEOPLE FISH FOR SO LONG, AND I HAVE BEEN WATCHING RISING TIDE AND HUNDREDS OF OTHERS FISH FOR A DAY AND A HALF, SO ON FRIDAY AFTERNOON I WALK INTO BUXTON'S RED DRUM TACKLE SHOP. After a show of knowing what I am doing, I pay $225 for a 9-foot Penn Spinfisher Big Game Surf rod and Penn 5500 SS reel loaded with 225 yards of 15-pound-test monofilament line. My friend Scott Taylor has offered me bottom rigs and hooks and two fresh mullet stashed in a small cooler for cut bait. At the last minute, I buy a frog's tongue sinker.

The drive to Cape Point resembles nothing like the trek I'd read about. My tires are in contact with hardtop until I pull off the road onto the beach ramp near the Cape Hatteras lighthouse, and it is but a 10-minute grind through soft sand to the Point.

Again I am struck by how closely its name reflects this lanceolate sliver of sand, impossibly frail and ever-changing. Its tip could literally be straddled, and 200 feet back the sand is but 120 feet wide, serrated by the rhythmic reach and retreat of frothy waves. A phalanx of trucks lines both sides of the spit, parked door handle-to-door handle close as the teeth of a comb. For a moment, I give grudging consideration to the thought of joining in, but I am intimidated by the scores of fishers crowded at the Point, by the realization that my tentative cast will brand me immediately as a beginner or, worse yet, that I will use a 4-ounce pyramid sinker when these waters clearly call — to those who can hear — for a 2-ounce frog's tongue or 6-ounce Sputnik.

So I drive a couple hundred feet north of the Point and back into a space beside a Dodge Ram truck flying the battle flag of the Confederacy. I assemble a two-hook bluefish rig outfitted with a blaze-orange and lemon-yellow attractor bead and snap to it a 4-ounce frog's tongue sinker. From the mullet, I cut two strips of flesh and push the hooks through, smearing scales on my fingers. Then I flip the reel's wire spool bail into casting position and hold the loose line against the rod with my index finger.

The flush of water from the first wave is colder than I'd hoped. I drop the rod tip back over my right shoulder, let the lead sinker touch the beach, then snap forward from the waist, pushing the rod tip overhead as the line sails over the water, pulled along by the tumbling mass of lead and dead fish and sharp hook. It disappears beyond the breakers with a satisfying splash, 20 feet farther than I expect. I reel in the slack until I feel the tug of taut line against the fleshy tip of my finger.

For the moment, I am heedless of the mule's failing vision. At least in one regard I am indistinguishable from all the others on the beach.

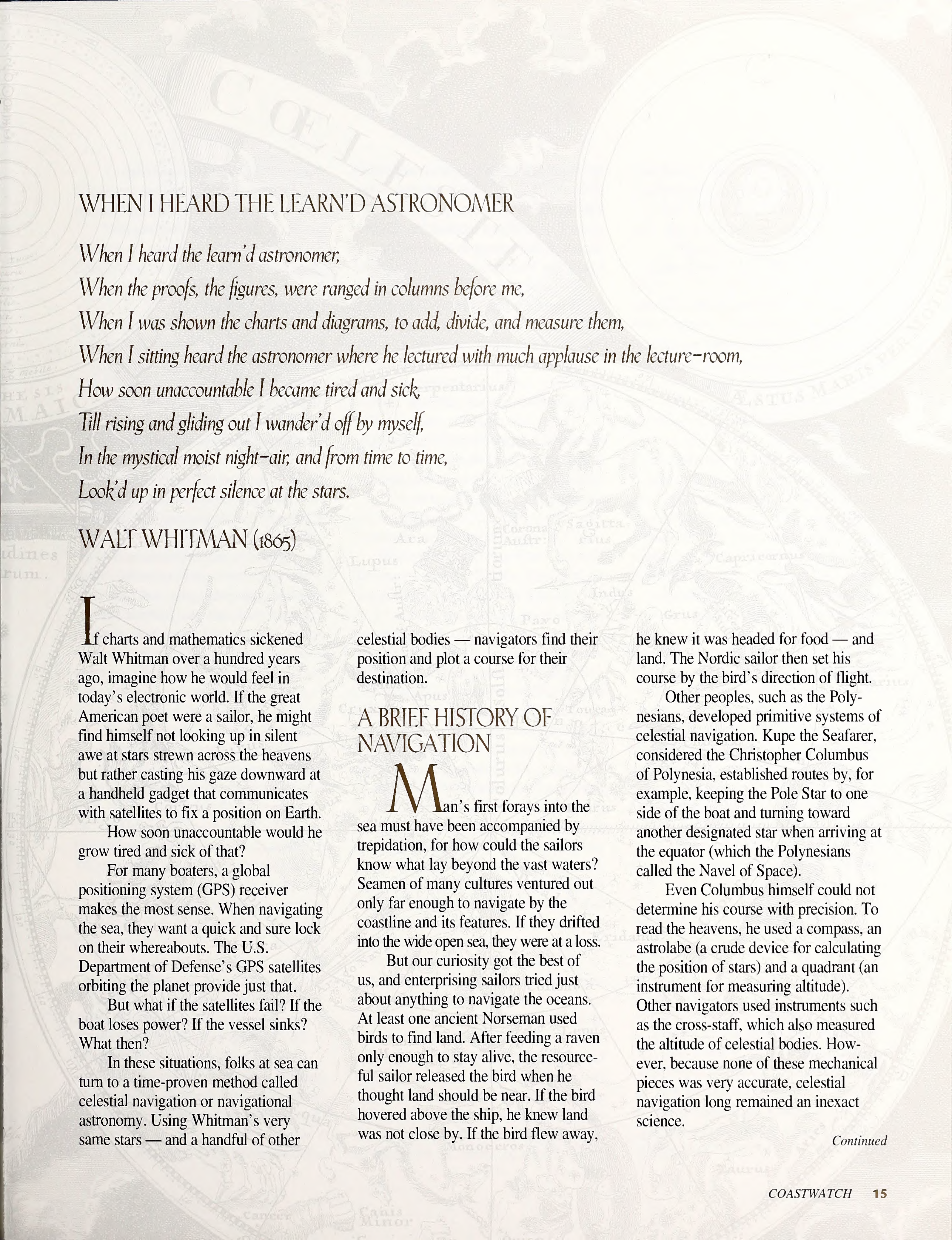
I fish and hope. ◘

SETTING SIGHTS ON THE STARS

By Daun Daemon

Erin Wall

At right: Capt. Steve Beuth holds the sextant with his right hand and with his left holds the index arm in a position so that the index mirror captures a ray of light from the sighted body and reflects it into a horizon mirror. The resulting image shows both the body and the horizon. The final step is to adjust the body's position so that it sits on the horizon.



WHEN I HEARD THE LEARN'D ASTRONOMER

When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure them,
When I sitting heard the astronomer where he lectured with much applause in the lecture-room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander'd off by myself,
In the mystical moist night-air, and from time to time,
Look'd up in perfect silence at the stars.

WALT WHITMAN (1865)

If charts and mathematics sickened Walt Whitman over a hundred years ago, imagine how he would feel in today's electronic world. If the great American poet were a sailor, he might find himself not looking up in silent awe at stars strewn across the heavens but rather casting his gaze downward at a handheld gadget that communicates with satellites to fix a position on Earth.

How soon unaccountable would he grow tired and sick of that?

For many boaters, a global positioning system (GPS) receiver makes the most sense. When navigating the sea, they want a quick and sure lock on their whereabouts. The U.S. Department of Defense's GPS satellites orbiting the planet provide just that.

But what if the satellites fail? If the boat loses power? If the vessel sinks? What then?

In these situations, folks at sea can turn to a time-proven method called celestial navigation or navigational astronomy. Using Whitman's very same stars — and a handful of other celestial bodies — navigators find their position and plot a course for their destination.

A BRIEF HISTORY OF NAVIGATION

Man's first forays into the sea must have been accompanied by trepidation, for how could the sailors know what lay beyond the vast waters? Seamen of many cultures ventured out only far enough to navigate by the coastline and its features. If they drifted into the wide open sea, they were at a loss.

But our curiosity got the best of us, and enterprising sailors tried just about anything to navigate the oceans. At least one ancient Norseman used birds to find land. After feeding a raven only enough to stay alive, the resourceful sailor released the bird when he thought land should be near. If the bird hovered above the ship, he knew land was not close by. If the bird flew away, he knew it was headed for food — and land. The Nordic sailor then set his course by the bird's direction of flight.

Other peoples, such as the Polynesians, developed primitive systems of celestial navigation. Kupe the Seafarer, considered the Christopher Columbus of Polynesia, established routes by, for example, keeping the Pole Star to one side of the boat and turning toward another designated star when arriving at the equator (which the Polynesians called the Navel of Space).

Even Columbus himself could not determine his course with precision. To read the heavens, he used a compass, an astrolabe (a crude device for calculating the position of stars) and a quadrant (an instrument for measuring altitude). Other navigators used instruments such as the cross-staff, which also measured the altitude of celestial bodies. However, because none of these mechanical pieces was very accurate, celestial navigation long remained an inexact science.

Continued

By the late 1700s, one invention had changed the course of navigation forever: the sextant, a tool still necessary for celestial navigation today. The sextant ensures accurate latitude readings, one half of the equation for solving a ship's position.

The other half, longitude, was not solved until a clockmaker named John Harrison developed the first reliable and accurate marine chronometer, a watch that keeps precise time at sea. (For a fascinating account of Harrison's achievement, read *Longitude* by Dava Sobel.)

"Before navigators were able to measure longitude, they used parallel sailing, which is basically sailing to the latitude and then traveling due east or west until they smacked into the land they wanted to go to," says Capt. Steve Beuth, coordinator of ship operations and instructor of nautical sciences at Cape Fear Community College in Wilmington.

Time is crucial to the longitude equation, says Beuth. The time of a celestial sighting must be accurate to the nearest second because a second's discrepancy will result in a quarter-mile error. (Earth spins 360 degrees in 24 hours, 15 degrees in an hour, 1/4 degree in a minute, 1/240 degree in a second. One degree equals 60 nautical miles, so 1/240 degree equals a quarter mile.)

With the ability to determine both latitude and longitude, navigating by the stars became routine.

CELESTIAL NAVIGATION IN THE MODERN WORLD

Celestial navigation relies on the navigator's ability to see certain celestial bodies. Only Venus, Mars, Jupiter, Saturn, the sun, the moon and 57 stars can be used for navigation.

The navigator must also be able to see the horizon, which makes timing very important. Stars are most useful for sightings when the sun is between three and nine degrees below the horizon (civil twilight, the time when drivers should turn on their headlights, occurs when the sun is six degrees below the horizon).

In coastal North Carolina, the window of time at twilight for viewing the celestial bodies well enough to obtain a fix is about 20 minutes.

Though the process involves a number of steps, navigating by celestial bodies is not difficult.

In an ideal situation, the navigational body will be positioned directly overhead, or at 90 degrees above the horizon. If this is the case, its latitude and longitude can be found in an ephemeris, a table of celestial positions for regular intervals, under the time the body was sighted. But it is the rare case when the orb is overhead.

Though not a goal of the navigator, taking measurements on the celestial body closest to 90 degrees above the horizon is a fairly neat task. After reading the angle with a sextant, the navigator determines the distance from the point where the body *would* be directly overhead.

If, for example, the sighted star is 89 degrees above the horizon, then the navigator knows he is 60 miles from the spot where it would be at 90 degrees. With this information, he can plot the position where the body is directly overhead and, using a compass, draw a circle with a 60-mile radius around it. The navigator's position will be somewhere on that circle.

But that's not very helpful. To determine the precise position, the navigator performs the same task again with a different celestial body. After drawing this circle on his chart, he will see that the circles intersect at two points. Common sense will rule out one of the points because the navigator will know he can't possibly be at that place, says Beuth. The other point, closest to where the navigator thinks he is, will be his position.

But even that scenario is unusual. Most of the celestial bodies sighted are lower on the horizon, and when a navigator reads his position by one of these stars, or by the sun as it rises, the process requires a little more mathematical tinkering.

The reason is that when the body is low on the horizon, the distance to the point where it would be overhead is very large. For example, a star 20 degrees high is 70 degrees from overhead. The point where it would be directly overhead is 4,200 miles away (70 degrees x 60 miles). A circle of that radius is too large to draw on a chart. However, the navigator can draw a portion of the circle using the altitude intercept method.

After choosing a position close to where he believes he is and marking the exact time, the navigator can look into a nautical almanac and find the star's declination (latitude) and hour angle (longitude). With this information, he can then consult a sight reduction table to determine its altitude at the assumed position. The only math involved is a bit of adding and subtracting angles, says Beuth, who teaches a celestial navigation course in the continuing education program at Cape Fear Community College.

Once the computed altitude is determined, the navigator compares it to the sextant reading. If the computed altitude is 26 degrees and the sextant reading 25 degrees, then the navigator knows he is 60 miles from his assumed position. To chart this out, the navigator plots the assumed position, measures the angle, situates parallel rulers and measures the distance from the assumed position (in this case 60 miles) in the direction away from the body.

"Finally, the reward is a line of position, a line perpendicular to the direction toward the body," says Beuth. "It's actually a chord of a bigger circle, a very tiny section of it. So we're somewhere on it."

To get an intersect and thus a fix, the entire procedure is done again with a different celestial body.

"The more bodies observed, the better you can fix your position," Beuth says.

WOULDN'T IT BE FASTER IF ... ?

Celestial navigation's concept of intersecting circles is similar to that of a GPS. Imagine a constellation of satellites orbiting the Earth, constantly emitting radio signals that contain precise timing and orbital information, data that can be processed by GPS receivers on the land, at sea or in the air. A timing signal is used to determine a position on the surface of an imaginary sphere surrounding the satellite. To fix a position, the device takes a reading from four satellites, yielding four spheres. Their point of intersection is the navigator's — actually the device's — exact position.

The entire process of acquiring satellites and obtaining a positional fix takes roughly two minutes with a commercially available civilian GPS unit. And a handheld device is about the size of a walkie-talkie. Thus, the GPS simplifies the navigator's task and streamlines the physical tools to one easily toted electronic gizmo.

So why even bother using celestial navigation except in emergencies?

Most navigators don't.

Ernst Hayman, a sailor in Beaufort, relies solely on GPS. He carries three units so that he's assured one is always working properly. Even so, he keeps handy the instructional books, charts, tables and tools for celestial navigation as the ultimate backup to his GPS devices.

The attraction GPS holds over celestial is twofold for Hayman: speed and accuracy.

As a novice at celestial, he figures using the technique would take up to an hour. More experienced celestial navigators might perform the computations in only 15 minutes. That doesn't sound like a long time until it's compared to the couple of minutes needed to operate a GPS. Also, the satellites can fix a position to within 10 meters (about 33 feet) — while the average accuracy for a celestial fix is within 1 mile.

And celestial navigation requires that the boater perform tasks exactly, even when exhausted.

"When you're tired, a GPS reads just the same. It doesn't get tired," Hayman says.

But, as with all electronic devices, it can fail. That's why Capt. Guy Grant, a navigator in Wilmington, uses both a GPS and celestial navigation.

"The prudent mariner should not rely solely on one means of navigation," Grant says. "If a satellite goes AWOL, then you've got something to fall back on."

He doesn't use celestial navigation exclusively, but neither does he let his celestial skills waste away. In fact, he maintains all of his books, tables and tools in top shape. And he's amazed that the U.S. Navy recently announced it would no longer teach celestial navigation skills to its midshipmen.

Grant says it's best for navigators to know all the levels of navigational technology and be able to use them, "even to the glass of water with a wooden needle in it" (a primitive compass).

And he knows no one who uses only celestial navigation when on the water.

"Even a diehard sailor is going to have a GPS stuck in his seat back," he says. "But I don't know that he'd admit it."

SILENT WONDER — BUT NOT MUCH HELP

Navigators start at a specific point, and they want to end up at a specific point. To accomplish this by means of the stars, a navigator must go through all the necessary motions and use the right equipment.

Instructions for lifeboat navigation explain how to cope without one necessary element at a time, for example the sextant or a clock, but not all of them, says Beuth, the community college instructor.

So the stars alone won't do it.

Constellations *can* help you see where you are, says Lee Shapiro, director of the Morehead Planetarium in Chapel Hill.

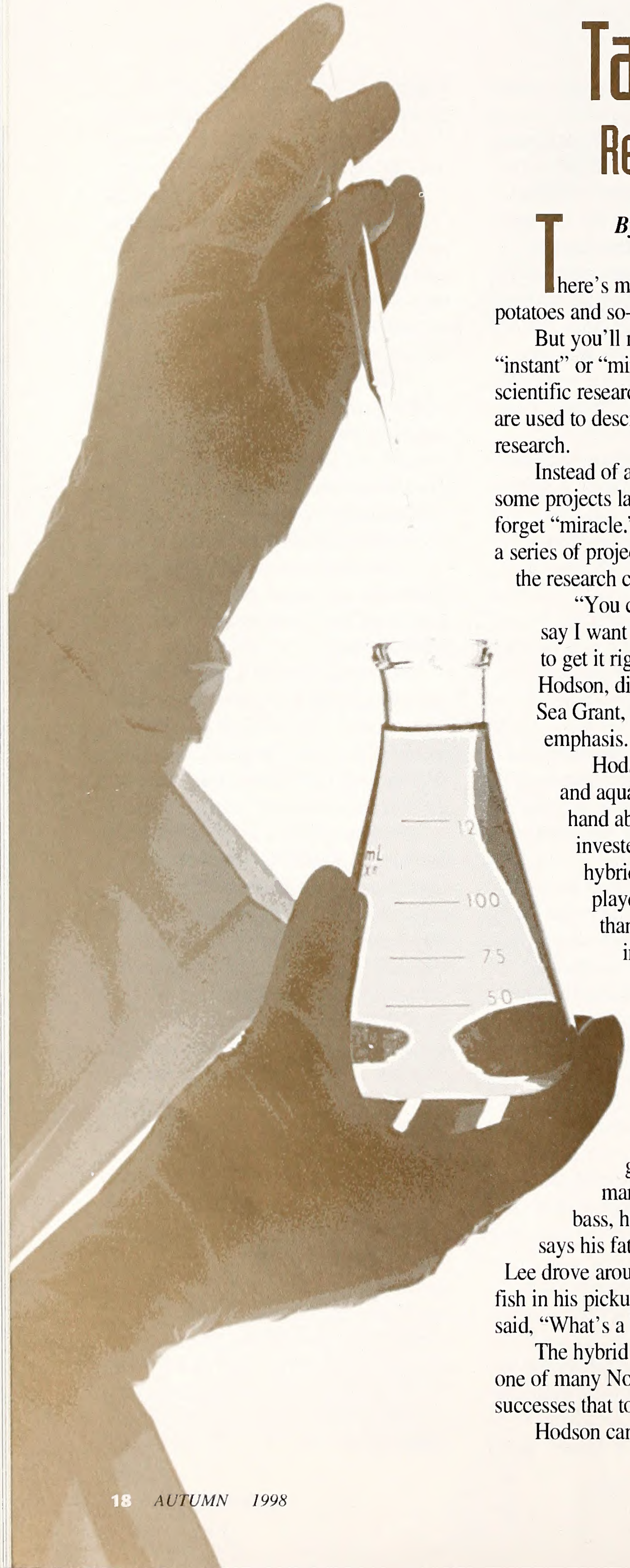
But using them to navigate is almost impossible because the heavens shift, he says. The night sky a sailor sees off the North Carolina coast in October will be different from the night sky he sees in January.

With no gadgets at all, a navigator can use the North Star only to approximate direction, but he would have to guess his latitude. While this approach may have been enough to set some folks off to sea in past times, modern sailors demand more precision.

"What we accept today as tolerable would have been very different in the 17th and 18th centuries," says Shapiro. "It's the difference between aiming for North America and for the Statue of Liberty."

So if Whitman were alive today, sailing the Atlantic and using the stars to get back home, he would not be able to avoid the charts and figures, the mathematics and tools of nautical astronomy. He could, however, gaze up in awe at the stars before grabbing his sextant, parallel rulers and charts.

If he opted for a GPS instead, he could look up in silent wonder at the satellites. ▣



Taking the Long View:

Research Reaps Results in Time

By Debbi Sykes Braswell • Photos by Scott D. Taylor

There's minute rice, instant mashed potatoes and so-called miracle cleaners.

But you'll never see the words "instant" or "miracle" associated with scientific research — unless the words are used to describe the outcome of that research.

Instead of an instant or a minute, some projects last for decades. And forget "miracle." In this field, it can take a series of projects before the results of the research can be put to use.

"You can't just go out there and say I want the answer — and expect to get it right away," says Ron Hodson, director of North Carolina Sea Grant, snapping his fingers for emphasis.

Hodson, a fisheries biologist and aquaculturist, knows first-hand about the years and money invested in research on the hybrid striped bass. He has played a key role in more than eight years of developing the pond culture of the fish and another 10 years of helping to develop domesticated broodstock.

The going has been slow. When Lee Brothers, a successful grower in Aurora, started marketing hybrid striped bass, he didn't get many bites, says his father, Harvey Brothers. Lee drove around with a few sample fish in his pickup truck, but people just said, "What's a hybrid striped bass?"

The hybrid striped bass industry is one of many North Carolina Sea Grant successes that took time to incubate.

Hodson can quickly click off a list of Sea Grant researchers at campuses across the state who have made important contributions to science through years of thorough research. Here are a few:

- ***Tyre Lanier***, an NC State University professor of food science. He has discovered ways to create moneymaking products out of food once considered a waste product.
- ***JoAnn Burkholder***, an NC State associate professor of botany. She is best known as a codiscoverer of the toxic dinoflagellate *Pfiesteria piscicida*. But Burkholder also has carried out years of research on the effects of nitrogen enrichment in coastal waters and examined the health of eelgrass meadows, an essential marine habitat that once covered acres in the sounds.
- ***James A. Rice***, an associate professor of zoology at NC State, and ***Larry B. Crowder***, a professor of marine ecology at Duke University Marine Laboratory. They have studied predator-prey relationships in fish and have extended their work to look at how the ecosystem figures into these relationships.
- ***Walter F. Clark***, coastal law specialist with North Carolina Sea Grant, and ***David J. Brower***, professor of city and regional planning at the University of North Carolina at Chapel Hill. They are working on recommendations for developing a comprehensive public trust policy for the state of North Carolina. In particular, state officials have struggled with the issue of what uses the state should allow in its waters and on its submerged lands.

Finding insight into issues like these isn't easy, Hodson says.

But the effort is worthwhile. ◘

Lee Brothers checks one of the 45 ponds in Aurora where he grows hybrid striped bass. He got his start applying years of Sea Grant research to commercial production.

Cultivating a Different Kind of Crop

Twelve years ago, people around Aurora laughed when Lee Brothers began to farm water instead of land.

They thought it was the most ridiculous thing they had ever heard of when Lee's father, Harvey Brothers, dug three ponds out of perfectly good land and Lee prepared to put eight years of Sea Grant research to a commercial test.

They're not laughing anymore. Now some of those same people are asking Lee Brothers to sell them young hybrid striped bass fingerlings and to teach them how to raise this cross between striped bass and white bass. Brothers was the first in the country to commercially pond-raise the fish, which is hardier and faster-growing than its parents and now makes state growers about $3.5 million a year.

The hybrid striped bass industry has come a long way since its unsure beginning. Production has increased every year since the first crop was sold in 1988-89. And the state has more than 25 licensed farms, including two that sell fingerlings.

Coming along later, the new fish farmers get to take advantage of years of research and experience focused on pond-raised hybrid striped bass. They also reap the benefits of the cooperative relationship that developed among Brothers, Sea Grant and a program called the National Coastal Resources Research and Development Institute (NCRI), which helps put research results to work in private enterprise and allowed Brothers to launch his experiment.

The scientists developed information about how to raise the fish commercially through years of research. Then, through practical trial and error, Brothers modified their findings for commercial production and learned how to handle the kinds of problems that hybrid striped bass farmers encounter, such as pests and low oxygen levels in the water.

In the last decade, Ron Hodson, director of North Carolina Sea Grant, and Craig Sullivan, an associate professor of zoology at NC State, have made advances in hybrid striped bass reproduction. The two developed hormone pellets that can be implanted in the fish to gain more control of its reproductive cycle and to make fingerling production more reliable.

Just this year, Sullivan and other researchers at NC State successfully spawned domestic broodstock, a significant step because broodstock now has to be caught in the wild every spring. When this effort is completed one day, the fish can be spawned year-round — without worries about fluctuations in nature year to year — and they can be bred to encourage particular genetic traits.

"In most cases research takes a long time, and obviously there is always something else to learn and discover," says Hodson, who has been instrumental in conducting the research and developing the technology used to establish the pond culture of hybrid striped bass. "Distinct benefits sometimes take a long time to develop."

Brothers' business, Carolina Fisheries, has been a good laboratory. In the beginning, he agreed to trade three years of information about commercial pond production for one year of fish and feed bought with a grant from NCRI. These days, he sells about 1 million pounds of food fish a year from Carolina Fisheries and surrounding farms, and he sells fingerlings as far away as Taiwan. Now, instead of three ponds, he has 45 covering 160 acres.

Although Brothers experiments on his own and keeps some of his findings proprietary, he continues to cooperate with researchers more than a decade after he started.

"Every year we learn something down here that helps," he says.

Take the sale of fingerlings, which Brothers has been producing for seven years. The national average for survival is about 25 percent. Carolina Fisheries'

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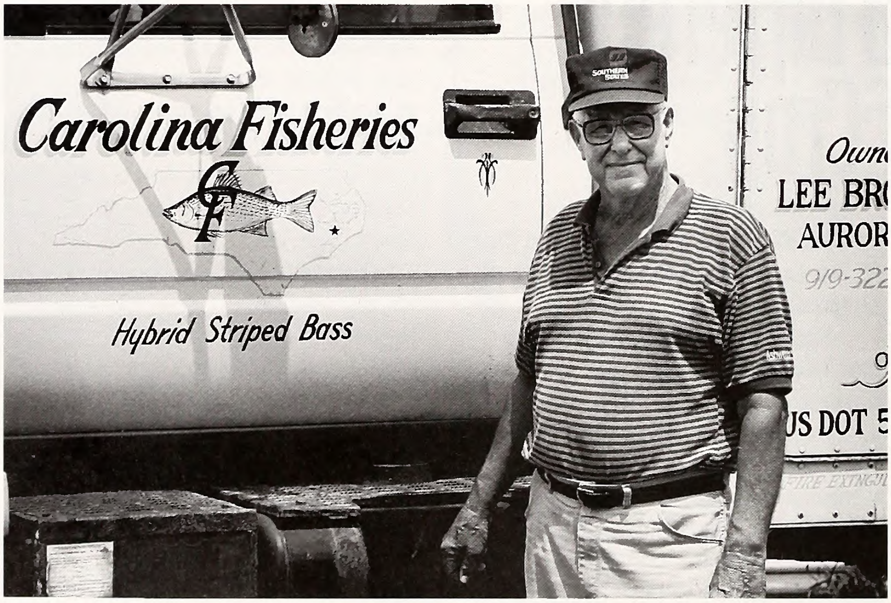
Lee Brothers and several employees gather fingerlings from a pond. Carolina Fisheries sends some as far away as Taiwan.



Harvey Brothers, Lee Brothers' father, says he can vouch for the power of research.

survival rate was 60 percent, but this year Brothers tried a few changes and brought up the rate to about 70 percent.

Harvey Brothers is one of the skeptics won over by the power of research. He's proud to point out that the government's original investment of more than half a million dollars through Sea Grant research and the NCRI grant has been repaid many times over through the growth in the tax value of hybrid striped bass farms.

"A lot of the research turns out not to work," the father says, "but this research has turned out to be a real moneymaker. Every time I see Hodson and Sullivan come down here, I get a smile on my face and I say, 'How are you going to make money for me this time?'"

But the application of research, with its gradual and uncertain payoffs, is clearly only for people with truckloads of determination and patience. Lee Brothers, who used to be a row-crop farmer raising corn and soybeans, says it just wasn't in him to quit.

"It's been a challenge from day one," Brothers says, his phone ringing and employees lining up with questions. "It's kind of like farming. You borrow a quarter of a million dollars and throw it on the ground. Sometimes you would make money, and sometimes you wouldn't."

Plumbing the Depths of Water Quality

In scientific studies, short time frames can work like carnival mirrors that twist ordinary people into wavy, thin ribbons or bulging balloons of flesh.

In a short-term view, the scientific facts and figures are there all right — just like the person's basic appearance in the carnival mirror. But reality is distorted.

That's the risk researchers and policy-makers run when they draw conclusions from too short a period of study, says Hans W. Paerl, Kenan professor of marine and environmental sciences at the University of North Carolina at Chapel Hill's Institute of Marine Sciences (IMS) in Morehead City.

Paerl, who has studied the Neuse River for almost 20 years, says the Neuse is so variable that it's hard to know what is normal unless you telescope out many years.

Unfortunately, the Neuse's "normal" hasn't been good for some time.

Mats of algal blooms have choked its waters, leading to foul odors, oxygen depletion in the bottom waters and toxicity. Scores of fish have died.

Still, it is not easy to predict the river's behavior because the environmental factors that control algal bloom dynamics vary tremendously from season to season and from year to year. Paerl says this problem makes it difficult to devise a mathematical model to explain what is happening to the water quality and to tell whether a particular management strategy is working.

"Modeling efforts will only be as good as the environmental data that are needed to establish long-term trends and degrees of variability, which will help us to distinguish human from natural impacts on water quality," Paerl says.

For example, the amount of nitrogen input — which Paerl helped determine was a key factor controlling algal growth in the Neuse — has bounced back and forth over the past five years. It rose from 1994 to 1996 before falling in 1997 and beginning to soar in 1998.

In another quirky indicator, so much rain fell at the beginning of the year that more fresh water flowed into the Neuse by May than in the entire year before.

"By solely evaluating highly variable short-term trends, one can erroneously conclude that the system is getting better or worse," Paerl says. "Only by teasing the short-term 'noise' from the long-term 'signal' can we establish a reliable trend."

That's why researchers need long-term data sets, and that's why it's important to continue the monitoring well after the modeling, Paerl says. He credits organizations such as North Carolina Sea Grant, the National Science Foundation, the Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Geological Survey/Water Resources Research Institute and the state Division of Water Quality with providing the dollars to carry out years of vital monitoring activities accompanying research grants.

Hans Paerl has spent nearly 20 years studying the troubled waters of the Neuse River. His results have helped shape public policy.

"To really test these models, you have to continue monitoring," Paerl says. "The proof is in what the environment is telling you in the long run. This is particularly critical for evaluating the effectiveness of management steps, such as nutrient input constraints, mandated for improving water quality. You've heard the expression, 'It took a long time for us to get in this mess.' It might take decades for the system to recover and the water quality to improve."

Rick Luettich, an associate professor of marine sciences and environmental sciences and engineering at IMS, says, "There's this general perception that you can throw money at something for a year or two and fix it, but that totally underestimates a complex natural system like an estuary."

The research conducted on the Neuse River over the years has made a difference. In the late 1980s, the legislature enacted a ban on phosphates based partly on this research. As a result, the upstream sections of the Neuse are less plagued by algal blooms, Paerl says.

Now scientists have also identified nitrogen as a crucial ingredient for algal growth in the lower part of the river. Partially as a result of these findings, the General Assembly has called for a 30 percent reduction in the amount of nitrogen flowing into the Neuse.

Paerl says he knows some people tire of hearing about year after year of scientific study. They say it's time to stop studying and start acting.

But as monitoring continues and the years advance, the research tools improve and yield better information. Now, for example, researchers can measure bioactive substances such as antibiotics, plant growth regulators and modifiers, and various forms of growth-promoting nitrogen and phosphorus in the water that they couldn't before.

Paerl particularly applauds the Neuse River Estuary MODeling and MONitoring project (or MODMON), which includes scientists from UNC-Chapel Hill, North Carolina State University, Duke University, East Carolina University, UNC-Charlotte, the U.S. Geological Survey, the state Division of Water Quality and the Weyerhaeuser Corp.

Whereas the Neuse got only monthly checkups during the 1970s, "now we have probably one of the finest coordinated sampling systems in the nation," Paerl says. "The system is

Continued

being examined head to toe every week."

But Paerl says it's important to always look ahead in research. He and Joseph S. Ramus, professor of marine biology with Duke's Marine Laboratory in Beaufort, have set their sights on Pamlico Sound at the mouth of the Neuse River as the next logical step for study. They say Pamlico Sound is the largest estuary in the United States about which the least is known. It processes almost half of the state's freshwater runoff and receives water from five large watersheds. It is also a critically important fisheries nursery and recruitment habitat for North Carolina and the southeastern Atlantic coast.

"The blooms seem to be moving farther down the system," Paerl says about the need to monitor and evaluate water quality in the sound. "I think it's inevitable."

Research associate Troy Alphin, left, and Martin Posey, a biology professor at the University of North Carolina at Wilmington, examine their finds after they sweep for crabs.

Although tiny, juvenile blue crabs grow into the most important commercial fishery species in the Southeast.

Getting to Know Blue Crabs ... Flexibility Required

Road maps have a way of getting revised, reworked and just plain scrapped in research.

Ten years ago, when biology professor Martin Posey received his first funding from North Carolina Sea Grant, he started out studying how marine life in general uses offshore reefs and sand flats as habitats.

Now the University of North Carolina at Wilmington researcher focuses on the habitats of blue crabs in particular — juvenile blue crabs to be exact. Five months into that two-year study, he was already discovering surprises about the kinds of places the thumbnail-sized young crabs may find refuge.

In a new twist, the scientists are looking into whether the tiny crustaceans turn to low-salinity waters as places to grow and avoid predators rather than only hide out in saltwater structures like sea grass or oyster shells.

"That's something we didn't even know about when we wrote this proposal," Posey says.

But research can take scientists through twists and turns they never imagined and challenge their original expectations. It takes flexibility and time to find answers to questions that keep changing.

Posey decided to focus on blue crabs because of their economic importance, and his research is all the

In just a matter of months, small juveniles that started out less than 1/4-inch wide grow into large juveniles and small adults like this one.

Martin Posey sweeps a net along an oyster habitat near Sneads Ferry as he checks for crabs.

more compelling because of the growing interest in crabbing and some signs that crabbing may be declining. Blue crabs are the most important commercial fishery species in the Southeast with a market value of $124 million per year along the Atlantic and Gulf coasts. More people are joining the industry in North Carolina and Florida, but the harvests aren't growing.

"We need to know what the critical habitats are in order to manage them, protect them and enhance them," Posey says.

What makes Posey's research even more useful is his choice of a region that hasn't been studied much for its crab habitats.

In a joint study with Florida researchers, Posey is trying to figure out what kinds of habitats juvenile blue crabs prefer along the North Carolina and Florida coasts and to see whether those habitats are interchangeable. In the past, more attention has been given to the mid-Atlantic and northern Gulf coasts.

The general theory has been that the vulnerable young crabs, which face the gravest danger from the claws of bigger blue crabs, would rather live in tangled masses of sea grass. But, Posey says, that theory doesn't explain how blue crabs have flourished along the southeastern coast of the United States, where sea grass doesn't grow from southern North Carolina to northern Florida.

To test the crabs' preferences, Posey and his colleagues are trying a number of approaches. In one, they compare the number of crabs they find monthly at three types of sites — sea grass beds, sand flats and oyster beds. They set up the North Carolina test areas at Masonboro Island, Swan Point and Middle Marsh and established two other sites in Florida.

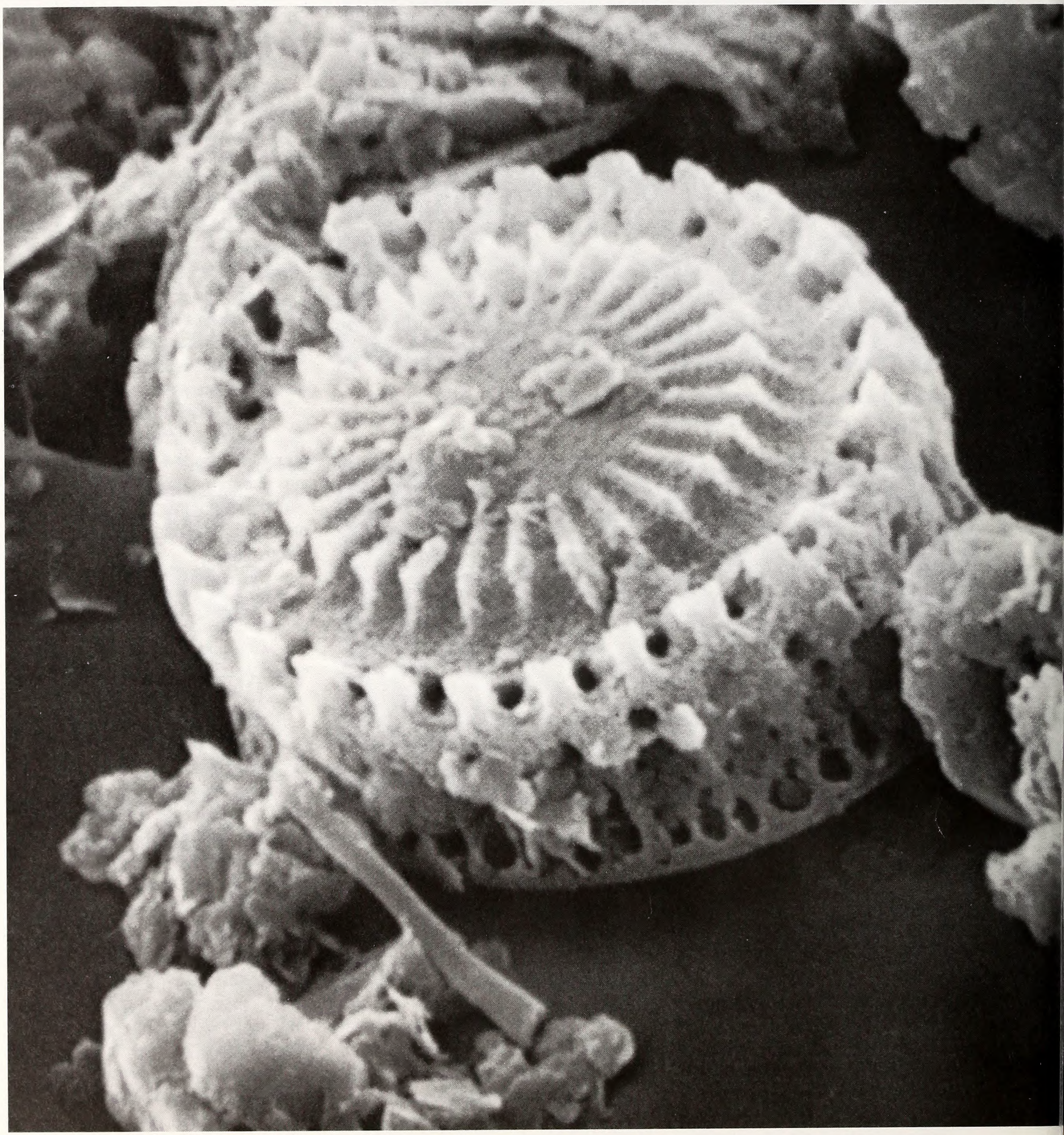
In July, when Posey and research associate Troy Alphin pushed sweep nets through the shallow water at Swan Point, they found more juveniles in the sand flats burrowing under the mud along the edge of the water. The results vary month by month, though.

The researchers also will look at the kinds of habitats juvenile blue crabs choose in laboratory experiments, and they will study the effects of predators by tethering the crabs in different types of habitats.

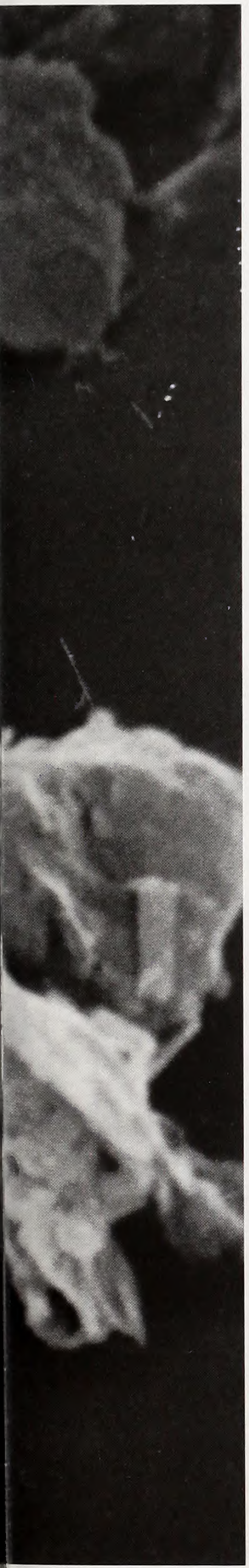
Posey's research is expected to yield crucial information about the early part of the blue crab's life. That information could help state regulators know which kinds of habitat to protect, Posey says. And protecting habitat would be a positive action to promote the well-being of crabs rather than a negative step such as enacting rules and restrictions.

With the study less than half finished, there's no telling how their hypotheses may be confirmed or challenged. For example, scientists may end up looking at fresh and brackish areas of estuaries in an entirely different light as blue crab nurseries.

"It's an area that's not been considered important for blue crabs," Posey says. "If that's true, there's a whole new habitat that we never thought of before that's critical." ◘



This scanning electron micrograph shows Paralia sulcata, *a diatom species that is found in sediments of the Pamlico and Neuse estuaries. About 25 of these diatoms, each 20 micrometers in diameter, could fit across the period at the end of this sentence.*



Nature Remembers

By David Cecelski • Photos courtesy of Sherri Cooper

When I was growing up by the Neuse River, we already knew something wasn't right. Fish had not yet started dying by the millions, and nobody would hear of *Pfiesteria piscicida* for another 25 years. But we knew not to swim in the river. The shad fishery, once the state's largest, had disappeared. And I still remember how, after a sudden thunderstorm capsized our boat off Minnesott Beach, I found my clothes soggy with a dull brown silt that I'd never seen in nature.

After diatoms and pollen are extracted from the sediment samples, Sherri Cooper makes slides of the material. She spends hours at the microscope identifying the diatoms and pollen grains and logging counts.

As I got older, the Neuse screamed that it was dying. Fish kills, algal blooms and dead zones became annual events. I even found signs posted at Slocum Creek, a Neuse tributary near our home, warning us not to eat the fish because of the dangers of nickel, cadmium and other heavy-metal poisoning.

How did the water quality in the Neuse and our other estuaries get so bad? The cast of culprits is pretty clear: corporate hog farming, agricultural runoff, land development, industrial wastes, municipal sewage. But with the exception of corporate hog farming, a recent phenomenon, we really don't know their impact on water quality before monitoring began in earnest in the 1970s.

What was water quality like before urban growth and phosphate mining? Before chemical factories and pulp mills? And, in the case of the anoxia (oxygen depletion) and eutrophication (nutrient overloading) that precipitate many fish kills, how can we sort out climatic influences from human causes?

Until I met Sherri Cooper, I assumed that these were unanswerable questions. Cooper, a paleoecologist at the Duke University Wetland Center, got interested in the North Carolina coast as a young girl, when she visited her grandmother's home at Core Point on the Pamlico River. Now she believes that the emerging science of paleoecology can provide at least some of the answers about what we've lost, how we lost it — and what we might regain if our estuaries can be saved.

Paleoecology is the study of living things and their environment in the past. The word itself sounds arcane, but it really expresses a common-sense idea: *Nature remembers*. Most people are aware of at least a few of the clues used by paleoecologists to decipher ecological history. Tree rings are one. By studying a core sample from the venerable bald cypresses that grow, say, in the Three Sisters Swamp along the Black River, a paleoecologist can recover a memory of rainfall as far back as when Jesus walked the earth. In the spacing and thickness of the cypress's rings, a trained eye can see hurricanes and droughts, fires, floods and the rise and fall of rivers.

Continued

Paleoecology is much more varied than studying tree rings, but you get the idea: *Nature remembers*. Most of nature's clues to the past aren't initially obvious. The history of forests, swamps and even seas is entombed in ecological remnants — pollen grains, chemical traces, river sediments, microscopic fossils. The paleoecologist's job is to scoop up these shards of the past and put them back together.

Until 1979, when Cooper's mentor, Grace Brush at Johns Hopkins University, traced the history of human influence on the Chesapeake Bay, few marine scientists believed that paleoecological methods would work in estuaries. They assumed that strong currents and tides would scatter sediments, wear away fossils, wash pollen out to sea. In the Chesapeake, Brush showed that she could successfully profile ecological changes dating back far earlier than the first European colonists. Later, Brush and Cooper teamed up to do a pathbreaking study of anoxia in the Chesapeake Bay, published in the journal *Science* in 1991.

Now Cooper is using a similar approach in North Carolina. With the support of the N.C. Water Resources Research Institute, she has begun to document the history of water quality in the Neuse and Pamlico estuaries. In the summer of 1997, she collected 2 3/4- to 5-foot sediment cores from seven sites. She divided her samples into 2-centimeter sections and dated them using lead-210, cesium-137 and radiocarbon techniques. The sediments are deposited on the estuary bottom a little bit every year, leaving a stratigraphic record that starts with the present at the top layer and goes back in time through the deeper sediments. Her deepest samples were laid down about 2,000 years ago.

To analyze the estuarine sediments, Cooper uses her full box of paleoecologist's tools. I found several of her methods ingenious. One involves collecting pollen fossils preserved in the sediments. Ragweed pollen is an especially interesting gauge of land clearing because this native plant proliferates in disturbed land. Cooper uses a measurement of ragweed pollen as an indicator of land clearing 50, 100 and even 1,000 years ago.

Cooper also looks for chemical clues to anoxia and eutrophication. These clues include concentrations of organic carbon, nitrogen, phosphorus, silica, sulfur and pyritic iron. Each tells her something different about the estuaries in the past. Historic levels of nitrogen and phosphorus are important, for instance, because nutrient enrichment is linked to the depletion of oxygen in estuarine waters. High nutrient levels often cause algal blooms that far exceed the ecosystem's usual ability to recycle them. When the unconsumed algae eventually die, they sink to the bottom, spurring an increase in the bacteria that help them to decay. As the dead algae break down, the bacteria use up the available oxygen, leading to anoxic conditions for other estuarine life.

Though a relatively minor part of Cooper's study, her tests for sulfur levels are another good illustration of the imaginative ways that these chemical traces can be used to track ecological changes in the Neuse and Pamlico. Estuarine sediments harbor anaerobic bacteria, that is, bacteria that don't tolerate oxygen. Unlike their oxygen-loving cousins, anaerobic bacteria metabolize naturally occurring sulfur, in the process changing the sulfate form found in seawater to a reduced form of sulfur known as sulfide.

Being highly soluble, sulfate mixes with estuarine waters and washes away. But sulfides are much more likely to combine with metals naturally occurring in estuarine waters, and they settle into bottom sediments. Thus, when Cooper finds a high

Daniel Jones, a lab technician, and Sunghea Kim, a master's student at Duke University, prepare to collect sediment cores from the Neuse River in July 1997.

A research crew brings a short sediment core on deck from the mouth of Bath Creek. The crew (from left to right) are Michael Madritch, an NC State undergraduate; Sunghea Kim; and Gary Dwyer, a Duke University research scientist.

level of sulfur in a sediment layer, she knows that the estuary suffered from a lack of oxygen at that time.

I know it's a complicated lesson in geochemistry, but I hope the point is clear: Once again, *nature remembers*. In this case, sulfur levels help to map the level of oxygen available to estuarine life across the ages.

Daniel Jones pushes out a sediment core on the lab bench at the Duke Wetland Center. The core, collected from the Neuse River estuary, will be divided into 2-centimeter sections and analyzed.

Cooper's study of fossilized diatoms is another intriguing way to explore the history of water quality. Diatoms are a distinctive kind of microscopic algae and one of the most common types of phytoplankton in our estuaries. Diatoms and other phytoplankton form the critical first rung in the estuarine food chain. They are the basis of all our commercial and recreational fisheries. Lose the phytoplankton, and you lose the fried shrimp and stuffed flounder.

Diatoms are useful in paleoecological research because they have a silica shell, known as a frustule. The frustule has two overlapping parts, like a pillbox and its lid. Because it is almost pure silica, the frustule is preserved in the estuary sediments after the diatom dies. And because each species of diatom has a unique frustule, they can be identified under a microscope.

Diatom species are numerous — Cooper counted more than 240 in her North Carolina sediment cores. And she expects to find more based on her research in the Chesapeake Bay, where she's counted more than 400. Some thrive better in salt water, others in brackish water, others fresh water. In fact, the species of diatoms in an estuary sample differ depending on a whole range of environmental conditions: not just salinity, but also light, pH, nutrient levels, substrate, temperature and pollution.

Thus Cooper can identify the diatoms in a sediment sample and tell a great deal about what kind of water conditions they lived in. It's like seeing an alligator, a cottonmouth snake and a bald cypress: You don't need to get your feet wet to know you're in a swamp. In this case, the presence or absence of certain species of diatoms helps Cooper recognize the historic levels of eutrophication, salinity and turbidity.

Cooper has only begun to reconstruct the history of water quality in the Neuse and Pamlico, but some interesting findings already stand out. Perhaps most importantly, her core samples show relatively few changes in water quality until the 20th century. (Her preliminary results, however, seem to indicate an intriguing rise in ragweed pollen counts in the 14th century. I can't wait to see how Cooper will explain it. A sudden rise in Algonkian settlement? A massive fire?)

Truly dramatic changes in water quality show up after World War II. Since 1950, sedimentation rates, nutrient levels and trace metal flux have increased significantly, sometimes by an order of magnitude.

All of Cooper's sediment samples show a striking decline in the number of diatom species over the last five decades. Diatom diversity has declined by nearly 50 percent in the Pamlico estuary. There have also been telling changes in the kinds of diatoms buried in the estuary sediments since 1950. These changes chronicle growth in eutrophication, turbidity, sedimentation, freshwater flow and industrial pollution.

Sunghea Kim, one of Cooper's students, conducted another paleoecological study of estuarine sediments as part of a master's project. The study indicates that trace metals in surface waters of the Neuse and Pamlico have risen dramatically over the last 50 years. Examples of trace metals include cadmium, nickel, chromium and arsenic. Many have reached quantities that exceed the U.S. Environmental Protection Agency's "threshold effect levels," that is, the point at which the trace metals affect the estuarine ecology.

Cooper hopes to follow other paleoecological clues in the future. Fossilized foraminifera, sort of microscopic conch shells, are good indicators of salinity levels. Charcoal tells of fire history. Seeds help chronicle changes in submerged aquatic vegetation. Algal pigments, also preserved in estuarine sediments, reveal variations in phytoplankton communities as a whole. All of these natural clues hold tremendous potential for understanding more about the history of water quality in the Neuse and Pamlico.

Paleoecology also holds a more general lesson. I've long taken for granted that each of us makes a lasting impression on the people whose lives we touch. A simple kindness, a loving gesture, a cruel remark, an unthinking slight — they all leave indelible marks on a human soul. Now, because of Cooper's work, I realize that we also make a lasting impression on every place we touch.

After all, nature remembers. ◘

David Cecelski is a historian at the University of North Carolina at Chapel Hill's Southern Oral History Program.

The Season for Stripers

By Jeannie Faris Norris

November at Cape Hatteras is prime time for catching prize stripers.

Scott D. Taylor

Pack the poles and the lures — it's time to head for the breakers off the Outer Banks. The striped bass gather there in the fall to overwinter, and they're just a cast away from the beach.

The autumnal cues of shorter days and lower temperatures propel stripers into the rough waters of inlets and breakers from Hatteras to Virginia. The fish will stay in this "staging area" from late September to March, says Jim Bahen, a fishery agent for North Carolina Sea Grant and an avid recreational fisher.

Angling for these big, silvery fish — named for the long, black stripes that run from head to tail — is typically best in the waters off Buxton, Bahen says.

"That's usually an area close to where they come into shore," he says. "They feed on bait that congregates around those areas. They're a big deal in Dare and Hyde counties, but they're also a big fishery in Martha's Vineyard in Massachusetts. Rockfish (another name for striped bass) are the number-one recreational fish up there."

Off the Carolina coast, anglers can cast for stripers from the beach or toss a line off a charter boat.

The best way to catch striped bass is to "sight fish" — to spot a school by watching for the gulls that flock as the fish prey on gray trout or speckled trout, a couple of their favorite meals.

"When I go fishing for rockfish, I'm looking for gulls," Bahen says. "Gulls tell us what's going on just below the surface of the water. When we see them hovering over or diving into the surf, there are usually fish feeding underneath them."

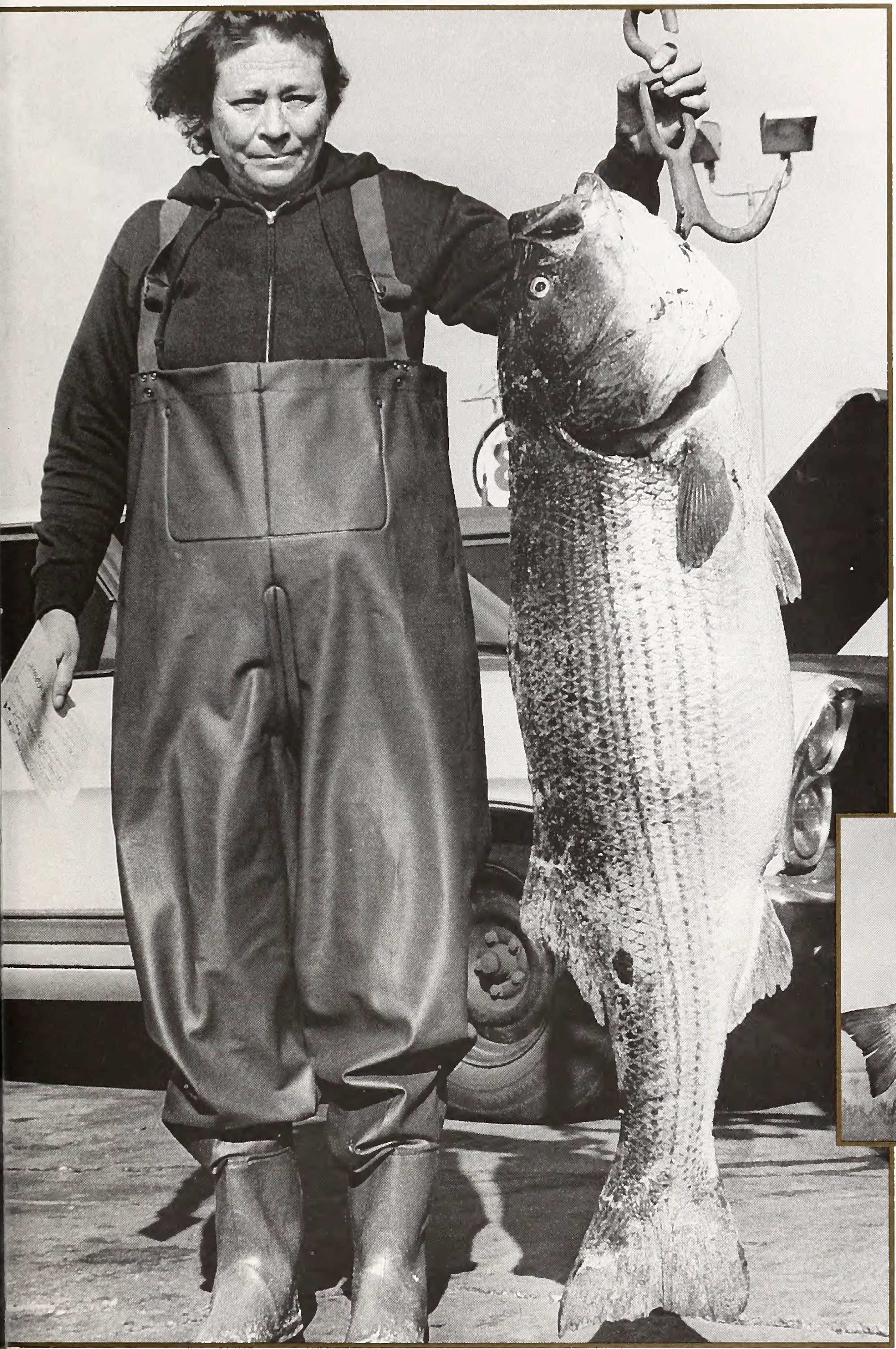
Bahen recommends using a 9- to 12-foot-long rod to throw the lure far into the breakers. Rig up with artificial lures because schools of striped bass are on the move. Get their attention with artificial lures cast and retrieved quickly through the surf, mimicking the movements of bait fish.

"Artificial lures are nice because their weight lets you cast far, and you need no action other than a steady retrieve," Bahen says.

One effective lure is a lead-headed jig — either white or chartreuse with a trailing plastic tail. Another is a metal spoon such as a Hopkins, a bright-silver, weighted piece of metal with a treble or single hook on the end. The single hook is preferable for successfully releasing your catch.

When you don't see gull activity over the water, try natural bait such as mullet or menhaden, Bahen says. The weight of the bait anchors it in the water until a fish happens by and takes a bite. This approach is more effective when striped bass aren't already feeding.

Ocean fishing for stripers remains good through March, when the mature adults leave the ocean and move into Albemarle Sound and up to the fresh waters of the Roanoke River. There, they will spawn in the river's fast currents



Catherine Harmon Willis of Hatteras set a state record in 1972 with this 60-pound striped bass

Dare County Tourist Bureau

around Weldon and Roanoke Rapids. After spawning, the mature stripers will return to the ocean in mid to late spring, where they will stay until fall. Meanwhile, the fish born in the river will remain there about five years before swimming to the ocean to join in the staging.

That you can catch striped bass at all is remarkable.

In the 1970s, their stocks suffered dramatic declines that were reversed only through a federal management plan — the first of its kind. As part of the plan, North Carolina and other Atlantic Coast states fell under an interstate system of size and bag limits that seriously curtailed striped bass fishing.

Today, North Carolina stocks have rebounded from 20 years of restrictions on harvests. The fishery management plan and its success in restoring stripers are a model for the state as it begins drafting its own plans for managing other declining stocks off its shores.

"This is a textbook case of fishery management," Bahen says. "We almost lost the species because of overfishing and lack of management. When we saw that, we did something about it and we protected it. Now we've got fish back in the numbers we can be proud of."

George Peyton Jr. of Rodanthe poses with his prize striper in 1970.

Aycock Brown

In January 1972, before the decline, Bahen recalls catching 45- to 50-pound adult female stripers off Oregon Inlet. But by the late '70s, the Atlantic migratory stock — striped bass in

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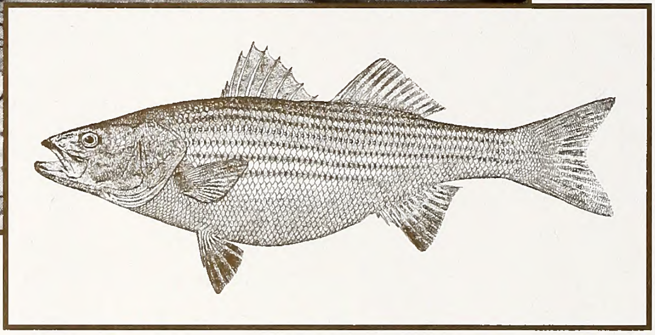
Fishers display a day's catch in Manteo before limits were imposed.

Aycock Brown



Courtesy of the National Oceanic and Atmospheric Administration

virtually every drainage area from Maine to Florida — was in decline. The Atlantic States Marine Fisheries Commission (ASMFC), formed to cooperatively manage and protect interstate fisheries, approved a coastwide plan in 1978 to reverse the problem. Meanwhile, Congress gave teeth to the plan by passing the Emergency Striped Bass Management Act.

Overfishing was identified as a major cause of the problem, so the ASMFC instituted size limits and bag limits, says Harrel Johnson, district manager of the N.C. Division of Marine Fisheries in Elizabeth City.

The goal was to reduce harvest to 80 percent of the average catch from 1972-79. Any state that failed to fish at or below that rate had to add restrictions on gear or fishing seasons. Maryland, however, took a different approach by placing a moratorium on striped bass fishing and starting a stocking program. As a result, Maryland rebuilt the fishery and reopened it in five years.

North Carolina, using a more permissive plan, met its goals in 1997.

"Maryland reached recovery faster than North Carolina, which opted not to go that far but to merely restrict commercial fishing back to a point required by the plan and to look at a longer-term rebuilding period that would result from that," Johnson says.

North Carolina was one of five producer states — states whose rivers contribute to the Atlantic Coast migrating stock — that were allowed to manage their fisheries in internal waters at an 18-inch minimum size limit. In the ocean, producer and nonproducer states had a 28-inch minimum size limit and creel limits.

Now, after 20 years of management, fishers say more striped bass are in the Albemarle than ever before.

"I agree with this assessment," says Johnson, who has worked in the Albemarle Sound area since 1974. "The population is considered to be recovered. It appears to be healthy, it is rebuilding."

Under the 1978 management plan, North Carolina commercial fishers were allowed to harvest no more than 98,000 pounds of striped bass per year. Today, commercial landings are 125,000 pounds, and the recreational catch is 120,000 pounds.

There are still restrictions: Fishers cannot keep striped bass smaller than 18 inches in the sound or 28 inches in the ocean. Recreational fishers can keep no more than two fish per day in the ocean, and on the sound, they can keep no more than three fish per day with a season varying from one month to six weeks in the fall and spring. Commercial fishers can harvest any day during set seasons until the quota is met — then, the fishery is closed and gear is removed from the water.

The ocean and coastal striped bass fishery is managed by the Division of Marine Fisheries; however, once the fish move into inland waters, they're managed by the N.C. Wildlife Resources Commission.

Spencer Rogers

Weathering Winds and Water

Steps for a Storm-Resistant Home

By Jeannie Faris Norris

You've seen the prestorm routine on the news: A hurricane is beating a path toward a coastal town. People are hurriedly boarding up and heading inland or talking tough about riding it out. They all hope for the best — that the wind and waves will spare their property.

But luck alone doesn't determine whether buildings survive the hurricanes and nor'easters that rake North Carolina's coast, says Spencer Rogers, North Carolina Sea Grant's coastal erosion and construction specialist.

Construction has a lot to do with it.

Well planned and constructed homes can survive raging winds and storm-whipped water. Even in older, damage-prone buildings, retrofitting can significantly improve wind and flood resistance with

Continued

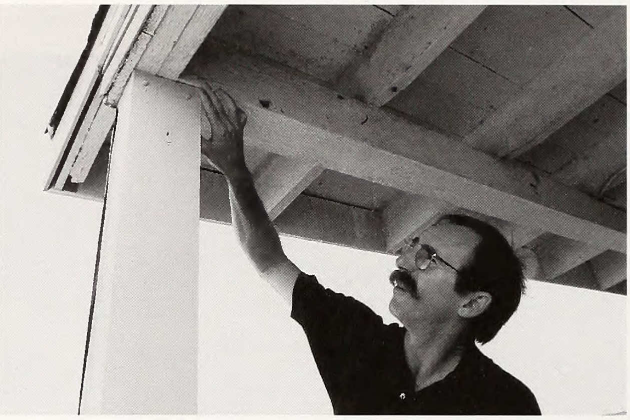
a few low-cost but carefully planned improvements. Proper connections can hold together a house in winds of up to 130 or 140 mph — more than Hurricane Fran's 120-mph gusts — and a high floor elevation and a deep piling foundation can protect a building from flooding, erosion and waves.

Beyond the coast, these same measures can equip inland homes to weather hurricanes, floods, tornadoes and other severe storms.

The best and least expensive way to make a building storm-resistant is to modify it while it's under construction, Rogers says. "Everything is open, you can get to everything, you know how it fits together, you know the hazards and can build accordingly," he says.

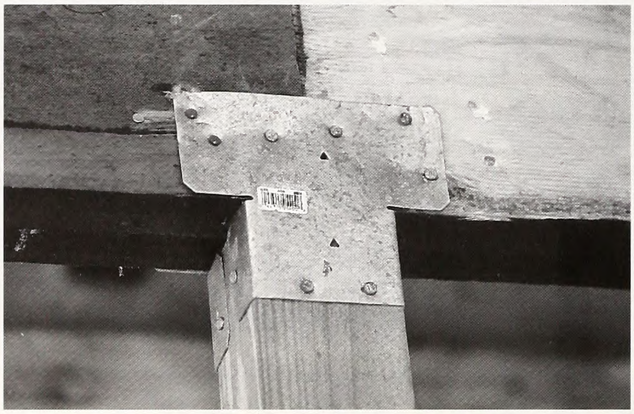
Retrofitting older buildings can be more difficult. But it's often worth the effort to make selected low-cost improvements even if the building cannot be brought to present codes.

Erin Wall



Spencer Rogers points out a spot where a hurricane strap is needed. High winds could take the roof off this porch.

Erin Wall



A bracket connects a column and a beam that supports the roof.

"Incremental improvements can make a big difference in damage to buildings in the future," Rogers says. "The lesser conditions will happen more frequently. We only may get 130-mile-per-hour gusts once every 50 years, but we might get 110-mile-per-hour gusts every 25 or 30 years."

FLOODING

Decades of experience lie behind Rogers' advice. Over the last 22 years, he's surveyed the structural damage from every major hurricane that has struck the East and Gulf coasts.

What has this work taught him?

"In simplest terms, the key is not to get wet and never, ever get hit by a wave," he says.

Buildings are most often destroyed by the waves and erosion that accompany storm-induced floods. Erosion causes structures to collapse, and the power of even small waves can pound a home into pieces. As unlikely as it sounds, research has shown that a 2-foot breaking wave can easily destroy a wall designed for 120-mph winds, Rogers says.

The remedies are a deep piling foundation and a high floor elevation. Piling foundations on oceanfront homes extend 5 to 10 feet below sea level so that waves can pass through unimpeded. In the midst of a hurricane, this feature can save a house from 5- or 6-foot waves above the storm surge.

Even existing buildings can be retrofitted to prevent flood damage. After Hurricane Emily in 1993, more than 50 homeowners on Hatteras Island raised their houses by 2 to 10 feet, Rogers says. They did this because they'd been flooded as many as three times in the previous 10 years.

"And while that sounds extreme, if you look at the cost of raising a building, it's actually surprisingly low for a drastic improvement in flood risk," he says.

Most of the expense comes in replacing the foundation and extending connections for sewer and utilities. The paybacks include new space under the building for storage or parking. You can even qualify for much lower flood insurance premiums in flood-prone areas, which can help pay for the construction costs.

Another technique is to move low-elevation utilities such as electrical outlets and switches that would short out and interrupt power to the rest of the house if they were flooded. An electrician can remove them and install replacements in higher elevations so they won't be as apt to get wet. Raising equipment or appliances — air conditioners, water heaters, heat pumps, water pumps — that are located in a flood-prone area of the house is also smart.

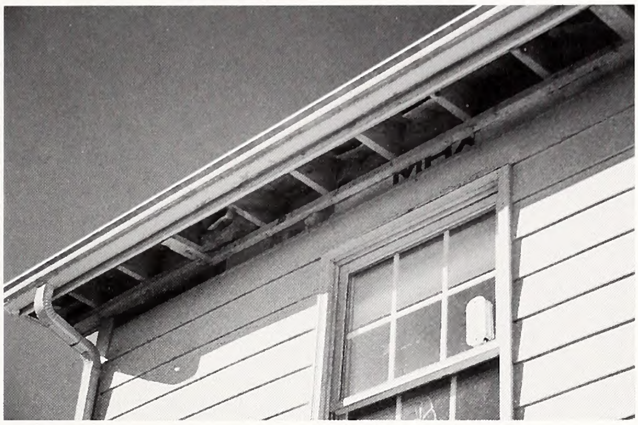
WIND

The maxim for success in real estate is location, location, location.

In hurricane-resistant construction, it's connections, connections, connections, Rogers says.

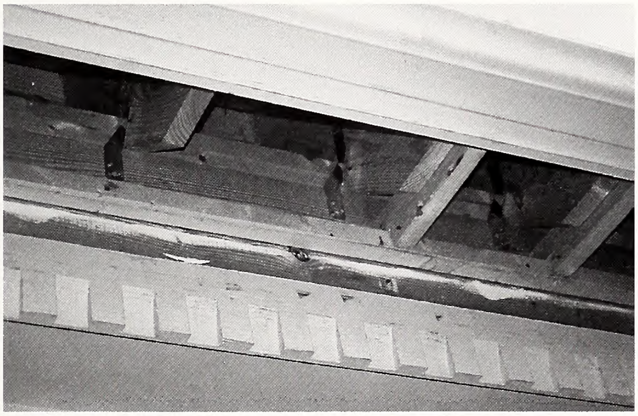
Wind damage is best prevented by strengthening the connections between the roof and walls and by protecting the integrity of the building envelope (roof, walls, windows and doors) from wind-blown water.

"It's not the board that breaks in a hurricane," Rogers explains. "It's what holds two boards together — usually a nail or a screw. It's critically important that everything be strongly tied together."



Spencer Rogers

Sheathing under the eaves has been removed to allow installation of straps between the rafters and exterior wall.



Spencer Rogers

Brackets have been installed.
These brackets will help the building withstand high winds.

Likewise, buildings don't simply blow over in the wind, as many people imagine, Rogers says. The damage is most often caused by inadequate connections and the wind's forces of uplift.

Wind uplift forces cause airplanes to fly, and the same principle applies to roofs. When a high-speed wind blows across a low- to moderately sloped roof, it creates a lift. The roof pulls off when the lift force exceeds the roof's weight plus the capacity of its connections to the walls. Without the roof, the walls collapse. But you can counter the problem by using metal straps and hurricane clips rather than nails alone to secure the roof. Hardware and building supply stores sell these connectors, which cost as little as a quarter each, and 100 of them can tie down an entire house.

"They can make the difference between a roof that might take off at 85 to 90 miles per hour versus one that could stand at 110 to 120 miles per hour," Rogers says.

Accessibility to the nooks and crannies where straps and clips are needed will make the task of installing connectors easier in some houses than others. The connections between the roof and the top of the wall is often most important, but the overall storm resistance is only as good as the next weakest link. To be effective, the connections must extend from the peak of the roof to the bottom of the foundation. But overconnecting a single link isn't worth the effort if other links are weaker. Paying a professional designer or knowledgeable contractor to check the building's weak links might be worthwhile, Rogers says.

Another uplift problem that caused major damage in Hurricane Andrew in south Florida was insecure roof sheathing or roof deck — the plywood that the shingles are nailed to. Since that's the highest structural part of the building, it must be well nailed to the roof framing. Typically, however, the buildings damaged by the 1992 storm had too few nails in place to properly hold the sheathing.

The solution is simple: Add more nails. Normally a difficult task, this becomes quite easy when shingles are being replaced. Just ask the roofing contractor to inspect the nails and add as needed before he installs new shingles. And while you're on the roof, Rogers recommends other techniques to improve the wind-resistance of asphalt shingles. He can provide these guidelines free.

Below the roofline, windows and doors are also important to maintaining the integrity of the building envelope. Homeowners should note how strong and well-attached they are. French and sliding-glass doors — with wide spans and poor connections in the middle — are troublesome. And large picture windows and double garage doors are often not strong enough to survive fierce storms.

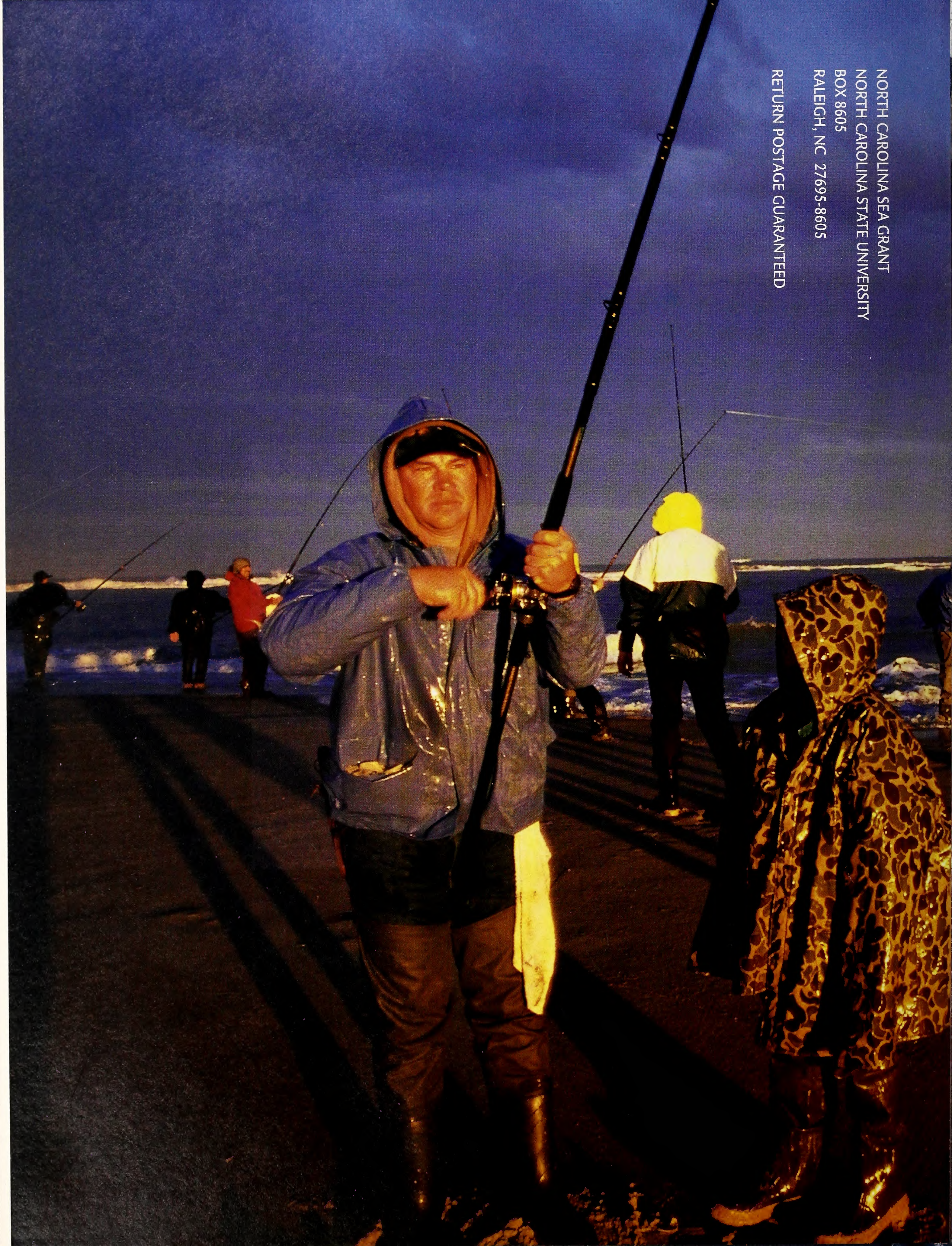
These are problems best addressed before a storm arrives because the consequences of a broken window or door can be dire, Rogers says. As wind enters the house, it increases pressure inside, which pushes up the roof. Meanwhile, the forces of uplift try to pick up the roof from the outside. Combined, internal pressure and external uplift can overwhelm a poorly connected building.

Commercial shutter systems can help prevent broken windows. Other less expensive alternatives include temporary shutters made of plywood or metal. Homeowners should make sure that temporary shutters are well connected to the building, Rogers advises.

"A poorly connected shutter is more dangerous than no shutter because you have a large piece of wood flying around," Rogers says. The American Plywood Association offers design guides on its World Wide Web site at www.apawood.org.

Ultimately, strengthening these connections and the building envelope can pay off. Rogers says insurance claim losses due to wind-blown water damage inside buildings are often three to seven times higher than the cost of repairing structural damage.

Contact Rogers for free copies of a homeowner's guide to hurricane retrofitting, Is Your Home Protected From Hurricane Disaster? *or Project Blue Sky's construction guidelines for asphalt shingles. Call 910/256-2083 or write North Carolina Sea Grant, Center for Marine Science Research, 7205 Wrightsville Ave., Wilmington, NC 28403.*



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From the Editors

Dreams

Humans are creatures blessed with the ability to dream, to envision change, to look ahead and yearn. During the holiday seasons particularly, we spend time considering our desires.

At Christmas, toys left under the tree are dreams come true for children. At the turn of the new year, we evaluate our lives, resolving to turn dreams into realities. Whether it's a vow to be more environmentally friendly or a determination to better ourselves, we envision how we want to effect change.

We all have dreams. Even organizations like Sea Grant have dreams. In that more formal setting, we call them goals, but they're dreams all the same. And now, with new leadership, Sea Grant has begun to dream anew.

Ron Hodson, who stepped in as the program's director in July, envisions a future for Sea Grant as an advocate for strong, unbiased research. We at Sea Grant don't use the word "advocate" much. That's because our organization doesn't take positions on coastal issues — erosion, fisheries, estuarine ecology, aquaculture, property rights — although some of them are contentious. Instead, Hodson wants Sea Grant to continue to advocate sound research and translate it into information that North Carolinians can use to make good choices.

Within the organization, however, are individual people, each with his or her own dreams. Here at *Coastwatch*, we have decided to make some personal dreams come true. Both of us are leaving the program to chart a new course in life.

In August, Jeannie Faris Norris left with notebooks and textbooks in hand to return to school. However, she has continued to work part-time with Sea Grant and contribute to *Coastwatch*.

In September, Daun Daemon hit the Oregon Trail with her husband, who found his dream job in the Portland area. A published fiction writer, she will take some time to craft stories, and so she bids North Carolina farewell — with her writing notebook in hand.

An entirely new team of editors with new dreams will now steer the course of the magazine.

Renée Wolcott Shannon, also a fiction writer, is completing her NC State University master's thesis, a novel about down-home North Carolinians. A career at Sea Grant is a natural extension of her interests in coastal life and marine science, fueled by her childhood experiences with marine-biologist parents. She brings informal science training and many summers on the North Carolina beaches to her writing for *Coastwatch.*

Ann Green is a Mississippi native with experience in journalism and public relations. She is a graduate of Louisiana State University and Georgia State University. Her articles have been printed in *The Atlanta Journal-Constitution, The* (Durham) *Herald-Sun* and the *Los Angeles Times*.

Katie Mosher will take the helm as communications coordinator and managing editor of *Coastwatch* starting with the Winter 1999 issue. Mosher brings to Sea Grant considerable writing, editing and managing skills from years of work in newspapers, television and, more recently, an online news service. Our longtime subscribers might remember Mosher's July/August 1994 article profiling the Mexican women who fill the labor needs in North Carolina crab houses.

Change is also coursing through Sea Grant's Marine Extension Program as a new leader steps in. Read more about this in the Winter 1999 issue.

So even though we are heading away from Sea Grant and into uncharted waters, we can assure our readers that *Coastwatch* will continue to supply news and information about everything that makes the North Carolina coast one of the most appealing areas in the country. With a new crew of editors and writers on deck, the magazine will be energized afresh while maintaining its traditional standards of excellence. ◘

Daun Daemon and Jeannie Norris

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Coastwatch

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Cozy up with a good book about the coast this winter. Leaf through the history of the barrier islands, read up on our fiercest hurricanes and tour Outer Banks lighthouses. 27

The Catch: **Untangling the Facts about Knots & Line**
Hone your fishing skills while you lounge by the fire indoors. Practice standard knot-tying and learn the latest developments in fishing line technology to prepare for your next trip to the coast. 30

Maritime Morsels: **Winter Warm-Ups**
Comfort food tops our list when the temperature drops. Delicious seafood soups and stews chase away the winter chill. 32

Coastwatch

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The North Carolina Sea Grant College Program is a federal/state program that promotes the wise use of our coastal and marine resources through research, extension and education. It joined the National Sea Grant College Network in 1970 as an institutional program. Six years later, it was designated a Sea Grant College. Today, North Carolina Sea Grant supports several research projects, a 12-member extension program and a communications staff. Ron Hodson is director. The program is funded by the U.S. Department of Commerce's National Oceanic and Atmospheric Administration and the state through the University of North Carolina. *Coastwatch* (ISSN 1068-784X) is published bimonthly, six times a year, for $15 by the North Carolina Sea Grant College Program, Box 8605, North Carolina State University, Raleigh, North Carolina 27695-8605. Telephone: 919/515-2454. Fax: 919/515-7095. E-mail: faris@unity.ncsu.edu or kmosher@unity.ncsu.edu. World Wide Web address: http://www2.ncsu.edu/sea_grant/seagrant.html. Periodical Postage paid at Raleigh, N.C.

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Front cover photo of a stained glass window in the chapel of New Hanover Regional Medical Center by Erin Wall.

Table of contents photo of a stained glass window at Church of the Servant in Wilmington by Erin Wall.

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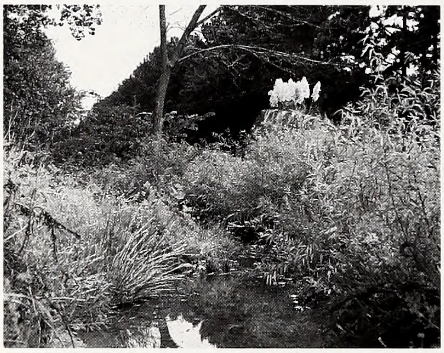
COASTAL
TIDINGS

Granted: One Clean Stream

Barbara Doll



Rocky Branch Creek after improvements in 1995

The Clean Water Management Trust Fund has awarded North Carolina State University a $1.1 million grant to continue the repair of Rocky Branch Creek, a stream that flows through the Raleigh campus, and to install stormwater filtration systems to treat runoff that drains into the creek. Barbara Doll, water quality specialist for North Carolina Sea Grant, is a co-investigator for the grant. In recent years she has raised awareness of the creek, which is polluted by oil, sediment and nutrients from campus parking lots and fertilized playing fields.

Like many urban creeks, Rocky Branch was forced into concrete ducts and squeezed between buildings, causing it to cut a deep, eroding ravine disconnected from its traditional floodplains. The creek will be returned to a more natural form with morphologically correct meanders in its course, a raised creekbed to reconnect it with floodplains, and new riffles and pools (areas where shallow water ripples over a ridge before flowing into a deeper pool). Where the water course has been constricted between steep banks, the improved stream also will feature artificial plunge pools, or waterfalls, which will dissipate the force of the water and prevent erosion. The entire project will take three years to complete.

The new funds complement Doll's recently awarded Environmental Protection Agency grant, which provides North Carolina Sea Grant with $55,700 to repair the upstream portion of Rocky Branch Creek, add an educational campus greenway beside the stream and survey the stream's invertebrate inhabitants. The grant brings together many NC State University departments, including the School of Design for landscape architecture of the greenway; Marine, Earth and Atmospheric Sciences for the stream's geomorphological classification; and the Zoology Department for surveys of aquatic organisms in the stream. — *R.W.S.*

In the Next Issue of *Coastwatch*

In the next issue of Coastwatch, T. Edward Nickens takes you for a ride on the Intracoastal Waterway, a 3,000-mile channel that runs inland of the nation's eastern shore. Along the way, Nickens chronicles startling contrasts in the waterway's passage through areas both urban and remote, and its colorful history as the East Coast's commercial and cultural corridor.

The boating theme continues as Julie Ann Powers takes a lesson in boatbuilding. She describes the frustrations and epiphanies of constructing her own 9-foot 6-inch sailboat and the rewards of taking the tiller for the first time.

And Ann Green introduces you to Harkers Island boatbuilders who practice a craft passed down by generations. They build a variety of boats — from work boats carved out of sweet juniper to luxury, custom-made sportfishing boats.

Corrosion in Coastal Buildings

Erin Wall

A hurricane strap connecting two beams.

One of the best ways to hold buildings together during severe storms is to install sheet-metal hurricane clips where the roof and walls meet. But when the Federal Emergency Management Agency (FEMA) realized how severely these connectors corrode when exposed to salt air, it sought help from Spencer Rogers, North Carolina Sea Grant's coastal erosion and construction specialist.

Rogers identified the serious consequences of corrosion for buildings near the ocean using historical records from LaQue Corrosion Services, a North Carolina firm specializing in corrosion testing for industry and the military. North Carolina Sea Grant has since funded more than 10 years of full-scale exposure testing.

Based on this work, Rogers wrote a FEMA technical bulletin, *Corrosion Protection for Sheet-Metal Connectors*, which is distributed nationally to coastal communities, builders and designers. Contact Rogers at 910/256-2083. ◘ — *J.N.*

Students Lauded for Food Technology Papers

Two North Carolina State University graduate students received first and second places in a student paper competition at the Annual Institute of Food Technologists Conference. North Carolina Sea Grant supported both students' graduate studies.

Carol Dombroski developed a novel approach to verify the safety of strategies used to eliminate *Vibrio vulnificus* bacteria from raw shellfish. These strategies, which apply low heat or freezing to reduce bacteria levels, are currently used to market raw in-shell oysters. *Vibrio vulnificus* causes blood poisoning that can spread quickly and prove fatal to people with compromised immune systems.

Dombroski worked with Lee-Ann Jaykus in the Department of Food Science.

Dina Requena focused on automating quality-assurance methods in the production of fresh Atlantic blue crab meat. She studied with S. Andrew Hale in the Department of Biological and Agricultural Engineering. ◘ — *J.N.*

Holiday Shopping Made Easy

Looking for an easy way to please the folks on your holiday gift list? Buy them an annual subscription to *Coastwatch.*

For $15, you can send your favorite friends and relatives to the coast six times a year. We'll provide you the gift cards free of charge.

Coastwatch explains the issues, science and changes that shape North Carolina's shoreline while reflecting its beauty, people and rich ecological diversity. The magazine provides in-depth science articles based on the latest research. It updates readers on seafood technology, aquaculture and other coastal industries. It explores the region's natural and cultural diversity. It introduces tourists and residents to a multitude of activities and places like canoe trails and landmarks. And it goes beyond merely telling its audience about science, seafood and sights by showing it all with illuminating photographs. ◘

Fisheries Commission Passes Rules to Protect State Fish

In September, the N.C. Marine Fisheries Commission passed new preventative measures to protect declining stocks of red drum until a fishery management plan can be developed.

Red drum, the designated saltwater fish for the state, can live up to 60 years. Unlike many fish that reproduce at an early age, red drum do not reach maturity (spawn and reproduce) until they are 4 years old and 27 to 30 inches long.

The Division of Marine Fisheries' most recent stock status report noted a dramatic decline in the number of red drum reaching maturity and listed the fish as "stressed-declining." A stock is considered to be in trouble if there are not enough mature fish to continue producing young fish at a consistent level.

The following temporary rules went into effect Oct. 22:

- size restrictions prohibit the possession or sale of red drum larger than 27 inches;
- bag limits reduce the recreational limit to one fish per day between the sizes of 18 and 27 inches;
- harvest limits implement a year-round commercial daily trip limit of 100 pounds with a 250,000-pound annual quota;
- gear restrictions require fishers to attend gill nets of less than 5-inch stretched mesh from May 1 to Oct. 31 of each year.

As part of the planning process, the commission must develop measures to stabilize the red drum stock until a fishery management plan is completed and implemented. The division immediately began the three-year process of developing a management plan for red drum. The temporary rules will be in effect until the plan is completed. ▣

Knauss Fellowships Offer Valuable Experience In Washington

A Sea Grant-sponsored fellowship program has allowed three North Carolina graduate students to work for a year in the Washington, D.C., offices of a U.S. senator and the National Oceanic and Atmospheric Administration (NOAA).

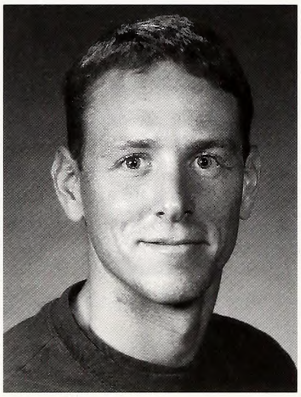
In January, the students will wrap up their participation in the 1998 Dean John A. Knauss Fellowship Program, sponsored by the National Sea Grant College Program.

The program was created in 1979 to offer firsthand experiences for students with an interest in marine, ocean and Great Lakes resources and in national policy decisions affecting those areas. It matches highly qualified graduate students with hosts in the legislative branch, executive branch or appropriate associations in the nation's capital.

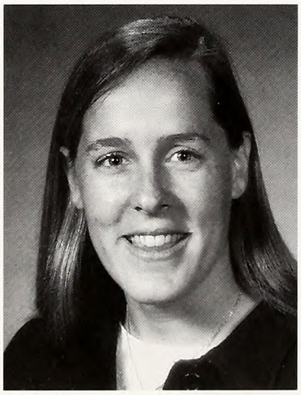
The 1998 Knauss fellows are Kristopher Pickler, Matthew Kendall and Katherine Colborn.

Herman Lankford

Kristopher Pickler



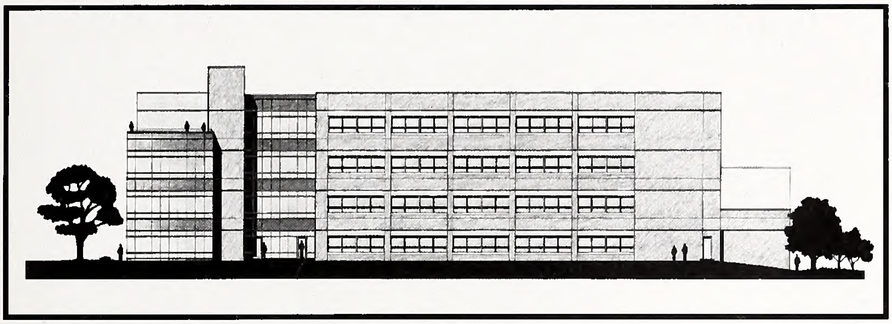
Matthew Kendall



Katherine Colborn

- Pickler, who is completing his graduate studies at Duke University's Nicholas School of the Environment, works in the office of Sen. Judd Gregg (R-New Hampshire). He advises Gregg on various marine policy issues, including New England fisheries management. Pickler also helped draft the National Whale Conservation Fund Act of 1998, which establishes a whale conservation fund for education, research and the protection of whales. In addition, he has reviewed NOAA funding for the Senate Appropriations Subcommittee on Commerce, Justice and State.
- Kendall, who recently completed his graduate degree in reproductive ecology at North Carolina State University's Department of Marine, Earth and Atmospheric Sciences, is working in NOAA's Strategic Environmental Assessment Division. He produces fish habitat maps for Puerto Rico and the Virgin Islands. The maps will be used by the Caribbean Fisheries Management Council and the National Marine Fisheries Service for coastal habitat and fishery issues.
- Colborn, a second-year student at Duke University's Nicholas School of the Environment, works in the Marine Mammal Division at the National Marine Fisheries Service Office of Protected Resources. She developed an in-house policy for marine mammal/aquaculture interaction. With the growth in the aquaculture industry, new policies are being initiated to protect marine life. Colborn also has written an article in *Professional Mariner* instructing captains how to avoid striking right whales at sea. ▣

— *A.G.*



The CMAST facility will be a world-class, multi-institutional marine science campus.

CMAST Groundbreaking – Coastal Collaboration

Want to know the latest research on North Carolina fisheries and how that research can help you get a better catch? How about access to an up-to-the-minute weather advisory that uses radar, satellites and remote instrument arrays in the sounds to provide accurate environmental data? North Carolina political leaders, academics and Sea Grant researchers met in Morehead City Aug. 31 to break ground for North Carolina State University's first coastal facility, which will provide these services and many more.

The Center for Marine Science and Technology (CMAST) will house classrooms; a "virtual library" with access to all the Triangle university libraries; an oceanographic support center that plans, builds, calibrates and refurbishes instruments for field research; and laboratories for coastal biologists, oceanographers, geologists, veterinarians and visiting scientists. The facility also will contain NC State University's seafood processing laboratory, where Sea Grant researchers study ways to ensure the safety of North Carolina seafood and develop new products to enhance the value and marketability of these catches. A Sea Grant extension office will provide research results to the public through workshops and outreach programs.

How did plans for this facility come about? For decades, NC State University researchers and Sea Grant extension agents had to rely on "borrowed" office and research space on the North Carolina coast. When Carteret Community College agreed to house Sea Grant extension agents, intense interest from the research community prompted proposals for a larger, shared facility. CMAST is now a cooperative effort among NC State University, Sea Grant, the University of North Carolina at Chapel Hill and Carteret Community College. The center's collaborative spirit is emphasized by its location at the edge of Bogue Sound, only four miles from the Duke University Marine Lab and the National Oceanic and Atmospheric Administration fisheries lab on Pivers Island.

People who helped make the CMAST vision a reality include B.J. Copeland, former director of North Carolina Sea Grant; Len Pietrafesa, of the NC State University College of Physical and Mathematical Sciences; and Ray Fornes, former chair of the NC State University Marine Sciences Council. Instrumental players in Carteret County include Lockwood Phillips of the *Carteret County News-Times*; Don Bryant, president of Carteret Community College; and Don Kirkman, director of the Carteret County Economic Development Council. North Carolina Sen. Beverly Perdue and North Carolina Reps. Jean Preston and Ronnie Smith secured funding for the project. ◘

— R.W.S.

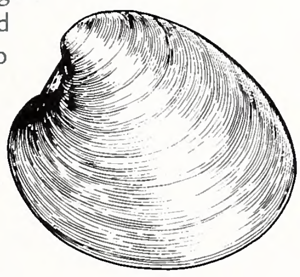
Fish Online

To get the most up-to-date information on fisheries rules and regulations or to learn more about North Carolina's marine resources, visit the Division of Marine Fisheries Web site at <www.ncdmf.net/>.

The popular site, which averages 1,000 hits per week, features profiles of major fisheries, recreational and commercial landings, stock status reports, a special "Kool Kids" page and highlights of the division's efforts to protect and conserve the state's marine and estuarine resources. ◘

Attention Shellfish Lovers

Hungry for clams? Get your hands on *A Guide to Recreational Clamming: Keyholing*, written by Sea Grant marine extension agent Wayne Wescott, and collect these tasty shellfish yourself. Wescott explains several clamming techniques: finding exposed clams, scanning for sign, raking and using touch. To order a copy, send a check for $2.50 to North Carolina Sea Grant, Box 8605, NC State University, Raleigh, NC 27695-8605. Ask for publication UNC-SG-98-01.



Before you hit the mudflats, contact the Division of Marine Fisheries about permanent and temporary shellfish closures. About 60,000 acres of state waters are closed to shellfish harvest because of health concerns. Many other areas close temporarily after heavy rains, when stormwater runoff flushes bacteria into estuaries. Because oysters, clams, scallops and other shellfish are filter-feeders, they suck in waterborne bacteria and pollutants and can pass them on to consumers. Call the division at 800/682-2632 before you go shellfishing. ◘

Jimmy Johnson and Sarah Harris of the Washington Crab Co. Inc.

Herman Lankford

FDA's New Safety Rules

Test Tar Heels in the Seafood Business

By Debbi Sykes Braswell

The folks who catch tuna, dig clams and pick crabmeat for your dinner plate have all sorts of names for the seafood safety regulation that the Food and Drug Administration (FDA) began enforcing a year ago.

Just ask Barry Nash, North Carolina Sea Grant's seafood technology specialist, who has taught seafood dealers and processors up and down the coast about the program.

Officially, the FDA's regulation is called Hazard Analysis and Critical Control Point Program. Most people refer to the program by its acronym HACCP, pronounced "ha´-sip," but Nash can rattle off a few alternate interpretations:

- Hazard Analysis Creates Crazy People.
- Here's Another Command and Control Program.
- Have A Cup of Coffee and Pray.
- Hard, Agonizing, Complicated, Confusing Paperwork.

There's plenty of joking about the HACCP acronym, but not about its mission. HACCP aims to *prevent* safety

Continued

Herman Lankford

Workers at Washington Crab Co. Inc. pick about 28,000 pounds of crabs a day, cartful by cartful. To ward off bacterial growth, the meat is not allowed to be warmer than about 70 degrees.

Herman Lankford

hazards in seafood — such as salmonella poisoning or histamine in fish — rather than to detect and fix problems later.

Businesses that handle all types of seafood must follow HACCP's key sanitation rules. In addition, written safety plans are required for blue crab processors, smoked fish processors, dealers who sell shrimp treated with a chemical called sulfite, dealers who sell fish such as tuna that is histamine-prone and shellfish dealers who buy or ship out of state.

Through his contacts, Nash has found that businesses are genuinely trying to comply with the program.

"I can tell people want to be HACCP-certified, not just because it's the law, but because they want to make sure they do what's right for their customers. I think that's admirable," says Nash, who works at North Carolina State University's Seafood Lab in Morehead City.

One year into the program, FDA representatives and folks in the seafood industry agree that HACCP is working, and they wish the public were more aware of it. Some business owners say the Sea Grant training classes they took to prepare for HACCP helped them recognize potential hazards in their operations.

"There are a number of deficiencies because it's a new program, which we expected. But this year it's more of an education," says Roger Kline, director of the FDA's investigations branch for the Atlanta District, which includes North Carolina, South Carolina and Georgia.

Still, North Carolina seafood businesses — often family-run operations — have had to pay a price for this step toward safer seafood.

Jackie Varnam, who with her husband Nicky owns Garland's Fresh Seafood in the Brunswick County fishing village of Varnamtown, says they don't have the luxury of a big staff to keep up with HACCP paperwork. Garland's, which mainly deals in wholesale and retail shrimp, has one other employee.

"It's a lot of paperwork for small businesses," Varnam says. "You take large businesses, they've got somebody just to check the bathroom."

But the Varnams are a determined family. Nicky Varnam's father had opened the business for only two weeks in 1954 when Hurricane Hazel slammed it shut. He rebuilt the business, though, and the younger Varnams took over in 1984.

HACCP hasn't changed the way the Varnams do business "because we keep things clean and have tried in the past 14 years to update things," Jackie Varnam says.

But HACCP training did convince the couple to make a few changes, such as buying fluorescent lightbulbs covered with tubing and storing cleaning products in another location.

Jimmy Johnson, owner of Washington Crab Co. Inc. and chairman of the N.C. Marine Fisheries Commission, strongly supports the principles behind HACCP. But he tries not to think about how much money and time he has spent complying with the program, particularly in these tight times when the Asian financial crisis has cut labor costs in half for his competition.

"The price we're getting for crabmeat is the cheapest it's been in four years," Johnson says. "There's no margin in it — we're just hanging on until something happens. We were hoping that HACCP would give us a marketing edge."

Johnson hired Sarah Harris to write and oversee the HACCP program at his crab-processing plant. The company, which employs about 100 workers during crab-picking season, has never had any reports of illness related to its products. In two years, Johnson estimates he will have filled a four-drawer filing cabinet with HACCP documents alone.

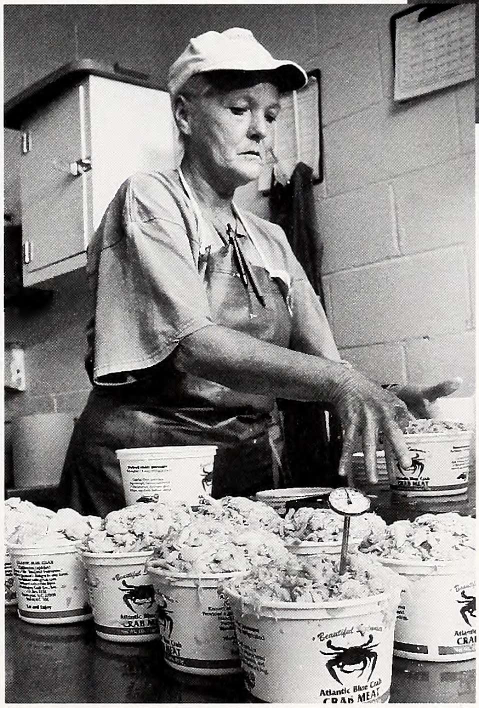
The beauty — and burden — of HACCP is in the documentation. For example, plant owners can now pull records to show they correctly cooked a particular batch of crabmeat or they stored a shipment of tuna at the right temperature.

They can do that because they now record the time and temperature at which each batch of crabs is cooked and monitor their coolers at least twice daily to make sure they work properly.

At first glance, Harris seems to be an odd choice for a crab-processing plant's HACCP administrator. Before she went to work for Johnson, she supervised quality control for a pharmaceutical company.

The beauty *— and burden — of HACCP is in the* documentation. *For example, plant* owners *can now pull records to show they* correctly cooked *a particular batch of crabmeat or they* stored *a shipment of tuna at the* right temperature.

Herman Lankford



Herman Lankford

"But whether you look at a drug process or a crab process, the principles are the same — it just smells worse," she says, laughing. As she talks, workers heft crate after crate of wriggling, fighting crabs into a cart destined for the steam cooker.

Harris' challenge is to make sure employees realize their role in making sure products are safe to eat. Unlike the pharmaceutical industry, the seafood industry has difficulty attracting local workers — 70 percent of Washington Crab Co. Inc.'s employees are seasonal guest workers from Mexico. Some of the company's few American workers quit this year when they were asked to sign documents stating that they completed in-house HACCP training sessions. The employees were afraid that signing the paperwork might somehow "jeopardize" their Social Security benefits, Johnson says.

"I can put in all the time I want coming up with a beautiful plan," Harris says, "but if they don't understand the concept behind HACCP, it doesn't matter. That is our biggest challenge."

The HACCP idea has been around since the 1960s, when Pillsbury executives developed the concept while working on packaged food for NASA's space program. They found that staving

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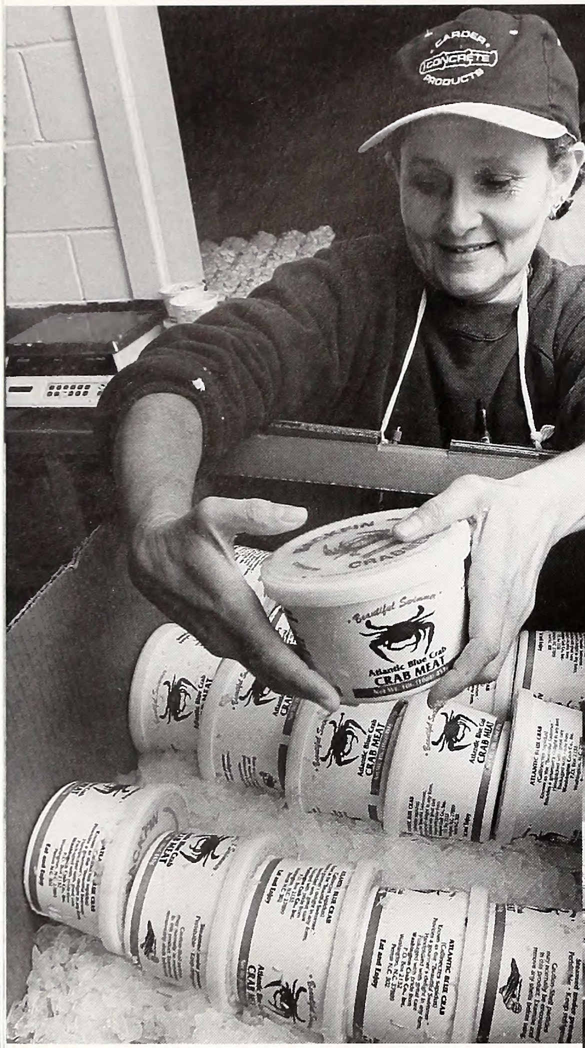
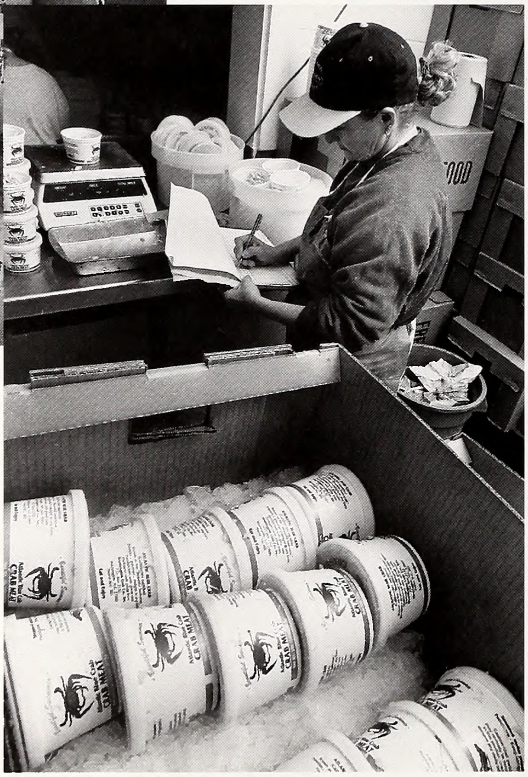
Herman Lankford



Under HACCP rules, *crab processors must* record *the time and temperature at which* each batch *of crabs is cooked and monitor their* coolers *at least twice daily.*



Herman Lankford

off problems in the first place was the best way to know the food was safe.

Under the FDA's seafood regulation, companies first have to scrutinize their operations for "hazards that are reasonably likely to occur and would cause illness or injury to the consumer."

These include biological hazards such as bacteria and viruses; chemical hazards such as histamine, which is produced naturally by bacteria on certain fish and can cause severe allergic reactions in some people; and physical hazards such as broken glass.

Businesses then must find ways to fend off any risks they discover through steps called "critical control points." To keep bacteria from growing on fish, for example, they refrigerate it. Or to reduce the risk of disease-causing bacteria, they harvest oysters, clams and mussels only from approved, unpolluted waters.

The businesses also have to explain how they will detect and respond to problems and how they can verify that their HACCP program works.

In addition, all companies that handle seafood must show they follow eight basic sanitation rules. For example, unsanitary objects cannot touch food and food packages. They also must document that their water comes from a safe source. They can't allow employees to work if they're sick or have certain wounds or sores.

Early on, Johnson was excited about HACCP's promise because it seemed to be a way for businesses to tailor food safety programs to fit their own operations. He earned HACCP certification six years ago, long before most people had heard of the program, and he has made several changes to help his business meet HACCP standards. Johnson built a separate ice room, and he used a Fishery Resource Grant from the state to install an automated monitoring system that checks the temperature of the coolers, freezers, crab cooker and pasteurizer. The company also sponsored its own HACCP training class for dealers and fishers this spring.

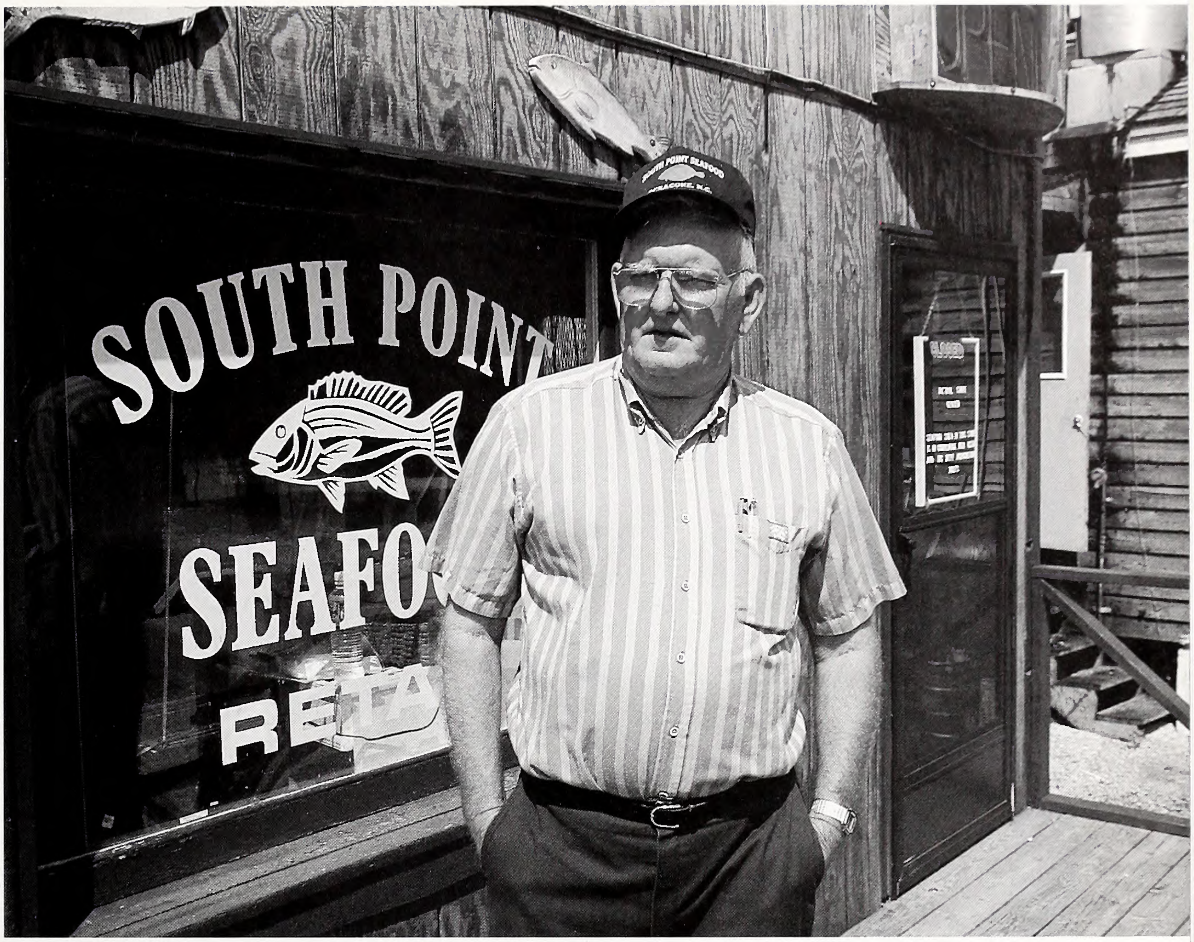
"I don't know anybody in North Carolina who's done more to get ready than we've done," he says.

That's why Johnson says he was disappointed, but not surprised, by the FDA's inspection this summer. He speaks highly of the inspector who conducted the review, but he says the agency took a "cookie-cutter approach" by penalizing his plant because its HACCP plan didn't mirror the FDA's guidebook in two areas.

"We used it as a guide, and they're using it as the Bible," Johnson says about the HACCP guidebook. In both areas, the company handled a potential risk through its sanitation standard operating procedures rather than as a separate critical control point.

One question concerned the way the company cools freshly picked crabmeat. All the company had to do was change the designation of that process to a critical control point because it was

Michael Halminski



Murray Fulcher, who owns South Point Seafood in Ocracoke, breezed *through his inspection this spring. His only fault was forgetting to* sign *two forms out of a mound of* paperwork.

already correctly storing the meat on ice and checking the temperature of the cooler twice a day.

The other issue was over keeping crabmeat at a safe temperature while it's being picked from the shells. Workers at Washington Crab Co. Inc. pick about 28,000 pounds of crabs a day, cartful by cartful. To ward off bacterial growth, the meat is not allowed to be warmer than about 70 degrees. So every time a worker picks 5 pounds of crabmeat, an employee removes it and stores the meat on ice.

But rather than use this system, the FDA suggested the company track the last crab in each cart, follow it through processing and make sure it never reaches 70 degrees. Johnson and the FDA inspector continue to discuss ways to handle this issue.

Kline, with the FDA, didn't know the specifics of Johnson's case. But he says the agency uses common sense in carrying out HACCP inspections.

"If a firm has a good program and all we disagree on is a critical control point, I can't imagine that being a big deal," Kline says. "Whenever you have a program this complex, I'm sure there will be differences of opinion."

Murray Fulcher, owner of South Point Seafood in Ocracoke, breezed through his inspection this spring. His only fault was forgetting to sign two forms out of a mound of paperwork.

"I don't see where it's anything different than what we've always been doing," says Fulcher, who employs three to five people and primarily sells fish wholesale. "The only difference is the record-keeping. Really, anybody who tries to have quality seafood was already trying to do what HACCP requires."

Still, Fulcher wonders what will happen to the companies that don't adopt a HACCP plan, much less stick to one. He is afraid those businesses will give the good ones like his a bad name.

Kline says FDA and state inspectors aim to check all of the nation's seafood manufacturers during the first year of HACCP. Next year, they will follow up with large manufacturers that had the most significant problems, and they will add wholesalers and other types of seafood businesses.

"We're doing everyone 100 percent — even one-person operations that are part-time — we're hitting them all, all of them that we know about," Kline says.

The FDA has 15 investigators trained in HACCP, and some states, such as North Carolina, also provide HACCP inspectors. Kline says inspectors are investigating foreign firms as well as domestic firms. But the agency gives special consideration to businesses from countries that have proven their seafood safety program is equivalent to HACCP.

When importers don't pass inspection, the FDA can detain their cargo indefinitely. The agency also can seize domestic cargo or issue an injunction if the company doesn't heed warnings.

"I think (HACCP) is going to make a difference," Kline says, although he adds that illnesses related to seafood are already rare. "From what I've seen of the inspections we've done and the state has done, we're finding that the industry is aware of HACCP." ◘

STAINED GLASS GLORY

An Artist-Craftsman and his Work

By Odile Fredericks
Photos by Erin Wall

In 1939, Rowan LeCompte fell in love on a trip to Washington, D.C. He was only 14 years old.

From that first day, the passion he felt visiting Washington National Cathedral has never subsided, giving rise to a lifetime of stained glass art that reflects his joy in creation. Today, the monuments to his labor enchant the nation, from that same cathedral, where his gigantic West Rose window glows like jewels among many other of his works, to his stained glass windows in the Episcopal cathedrals of Wyoming and Maryland and in the New York State Capitol in Albany.

Continued

At right: Rowan LeCompte painted the altarpiece at Church of the Servant in Wilmington.

Now in his 70s, the self-taught Baltimore native lives a quiet life in Wilmington, where he continues to work. In his studio, his fascination with the art is obvious as he holds a fragment of ruby-colored glass in his hands, explaining its beauty. Despite his age, LeCompte remains that young boy at heart.

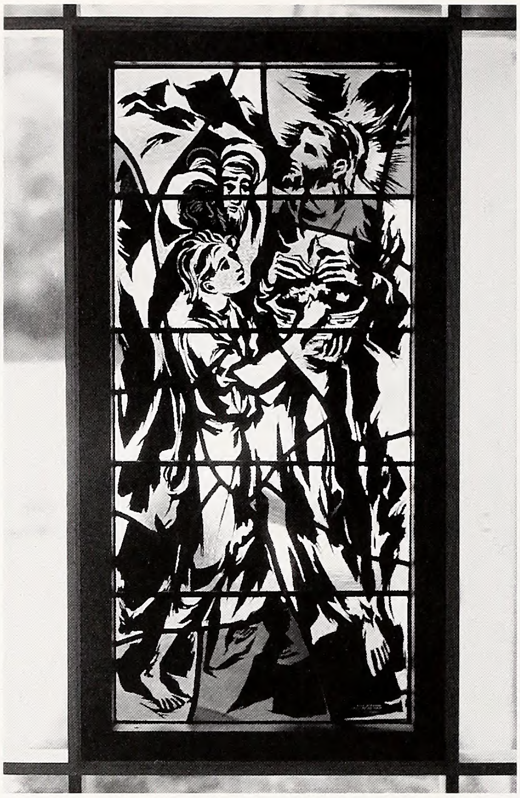
Dressed in gaily striped pants and a blue shirt that matches his eyes, he leaps to his feet to bring a prop for a novice who has trouble understanding how someone with no formal training in stained glass could scale the heights of the country's grandest churches.

"I cared passionately about the art of the thing," he explains. "I was not interested in becoming a businessman, turning out church windows. I wanted to do what would be creative and inventive and not a copy either of ancient windows or of other modern windows. I wanted it to be sincere and from the heart."

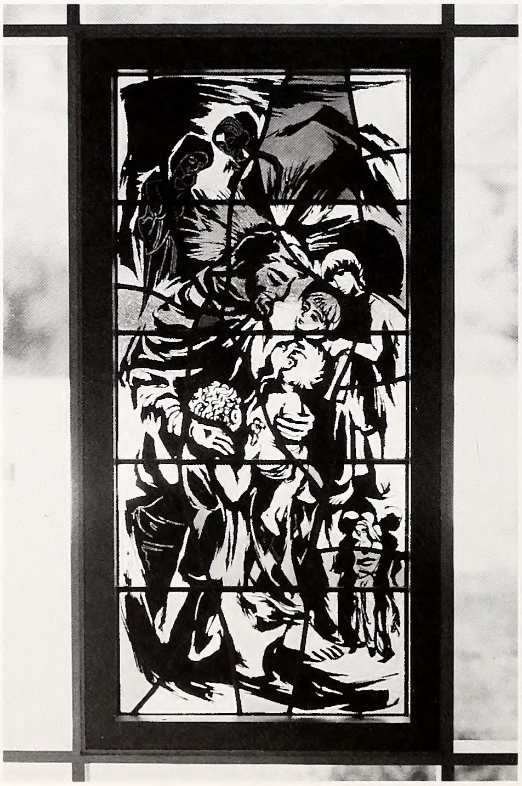
The West Rose window is a classic example of LeCompte's inventiveness. An abstract play on light, the rose contains innumerable bits of chipped thick glass and old-fashioned handblown glass. The effect in sunlight is a rich, sparkling brilliance.

The son of a middle-class family in Baltimore, LeCompte learned to trust his enthusiasm for art. From the beginning, he was intoxicated by color, music, architecture and painting. He remembers that day in 1939 when he first saw Washington National Cathedral as clearly as lovers recall their first encounter.

"It wasn't even half built at that time, but I was absolutely bowled over by it," he says. "I was obsessed by it and thought of nothing else after that. It was the first church of its size and certainly of its impressiveness and beauty that I had ever seen."



These windows appear side by side at Church of the Servant in Wilmington.



On subsequent visits, LeCompte says he noticed the effect of the windows already installed. Enthralled, he set off to the library to borrow books on the art and craft of stained glass. Then, with supplies from a local glass shop, he began to assemble his first work, which he now recalls was of "hideous crudity."

"As a 14-year-old I learned very quickly — everyone at 14 does — the mind is open," he says. "For my own pleasure and for family friends, I made piece after piece after piece, and each became a little more adept in design and technique."

Two years later, luck struck. A mutual friend introduced him to Philip Hubert Frohman, architect of Washington National Cathedral. LeCompte presented a sample of his work that so impressed Frohman that he offered to show LeCompte's designs for a small window to the Episcopal cathedral's building committee.

"Just before he went into the building committee with my drawings ... he asked me my age, and I said rather hesitantly, 'I'm 16, Mr. Frohman." He said, 'Good God! I thought you were older.'"

Nevertheless, the committee approved the design, and LeCompte made the window. When it was finished, Frohman was delighted.

"He praised it very highly ... and that gave me great joy, but also it was bewildering because I'd never received, and I certainly never expected to receive, such praise as that."

By the time LeCompte turned 17, America's involvement in World War II was in full swing. Seeking to leave his mark before going to war, he approached the clergy of a

Baltimore church he admired and asked if they would accept a small stained glass window. It would cost them nothing, he told them. He would show them a drawing first, and if they weren't pleased with the window, he would be willing to remove it, he recalls, chuckling at his earnestness.

"It was like asking someone, 'May I mow your grass, please, for free?'" he says.

LeCompte created the window and was halfway through another when church members whose son had been killed asked if he would make the second window as a memorial. He agreed and was thrilled when the family offered him payment. Until then, he had worked for friends and family, accepting whatever they gave. Before the second window was complete, another family who had lost a loved one appeared, requesting a window. Then another family came, and another, all who had lost young relatives.

"And you know, from that day to this, which is not just a few days," LeCompte says slowly, remembering, "I've never been without a commission. Sometimes, there's been only one, but I've always had at least something to work on, and that has made it possible for me to do this for a living as well as for love."

In Washington National Cathedral, LeCompte will soon have created 45 windows, including the West Rose, which measures 26 feet across. In 1999, he will finish the last two of a series of 18 clerestory windows, each 15 feet wide by 30 feet tall.

Church of the Servant altarpiece

A 23-year project, the windows will have the clarity and brilliance that once blazed down into the great medieval churches of France, such as the cathedral at Chartres, before those windows became clouded and worn by time. Unlike those of his contemporaries who sought to simulate the aged patina medieval glass windows now wear, LeCompte, a self-taught historian and avid researcher, tries to recapture their former sparkle even as his style is distinctively modern. So unusual was his work that for years after his return from the war, he received no commissions from Washington National Cathedral, where the trend at that time was very conservative.

LeCompte's windows retain their transparency, are bold, inventive and often playful, says Dieter Goldkuhle, an internationally known stained glass artisan who has worked with LeCompte on windows for the church since 1967. Unlike the cathedral's windows of the 1940s and 1950s, which tended to be 'studio' productions, his have a soul, Goldkuhle says.

Yet behind LeCompte's style is a master willing to labor with the elusive medium of light, studying where the window will be placed, the angle and strength of the sunlight touching it and where the viewer will stand to gaze upon it.

At the center of his work are the figures and images he loves — simple definitions yet infused with life. Like the man who creates them, they sing of the splendor of life and work.

"In every case, my effort is for the windows to be beautiful — if I can achieve that — to have an elegance and style, but also to have energy." ◘

In Wilmington, LeCompte's work includes a 4-foot circular window at the New Hanover Regional Medical Center chapel. Church of the Servant has one of his paintings as an altarpiece and two stained glass windows. In a year or two, the church will have another of his windows.

LeCompte also is working on a large stained glass window for Garber United Methodist Church in New Bern. ◘

Decking Out:

Christmas Flotillas Light and Delight

By Jeannie Faris Norris • Photos by Scott D. Taylor

"Decking out" takes on a new meaning when holiday flotillas take to the water.

Boats of all sizes, festooned in colored lights, parade along waterfronts from Elizabeth City to Wilmington and beyond. Captains and crews go to great lengths to create elaborate scenes in the rigging or on scaffolding that invisibly supports the lights when darkness falls.

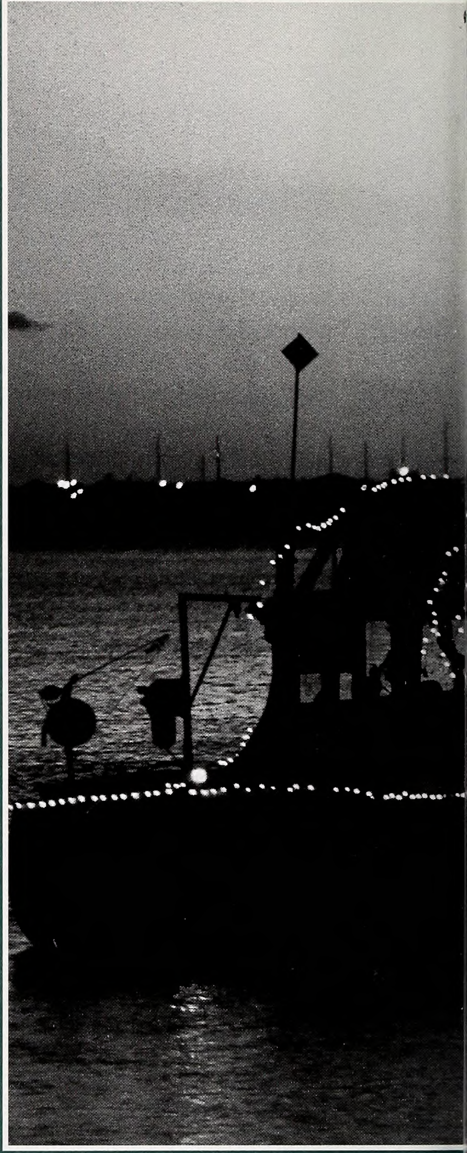
Year after year, they parade.

"It's definitely festive. It's riotously festive," says Janis Williams, marketing coordinator for the Carteret County Tourism Development Bureau. Last year, the Crystal Coast Christmas Flotilla, which travels from Morehead City to Beaufort, drew 5,000 onlookers, she says.

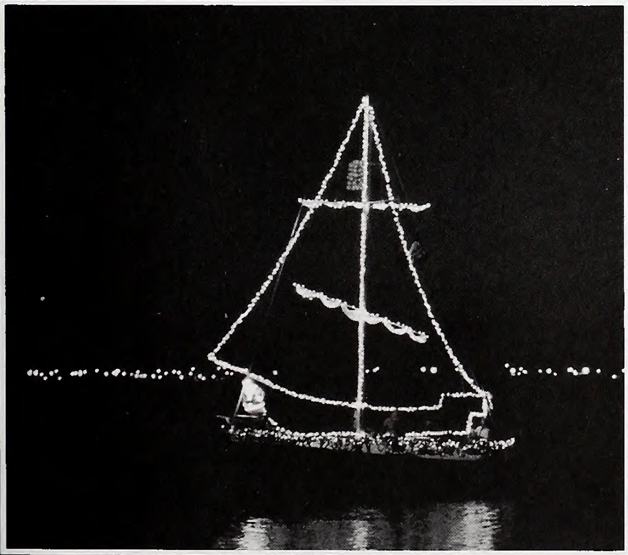
Some of the entries in flotillas are elegant — thousands of lights shimmer up the rigging of graceful sailboats. Others are comical — a lighted pair of dolphins rise and fall ahead of a small motorboat as though pulling it over waves. Tropical themes appear yearly as fluorescent palm trees sway in an imaginary breeze. Nativity scenes are created aboard some sportfishing boats. Lighted Christmas trees dance on others. Many blare Christmas carols, and crews almost always dress the part.

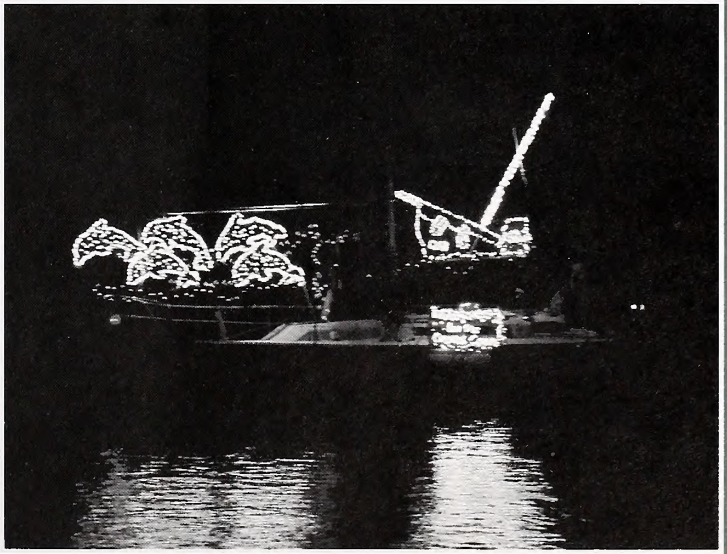
"It's so much fun for the crews aboard the boats, and there is a lot of interaction between the crews and the people who come for the parade," Williams says.

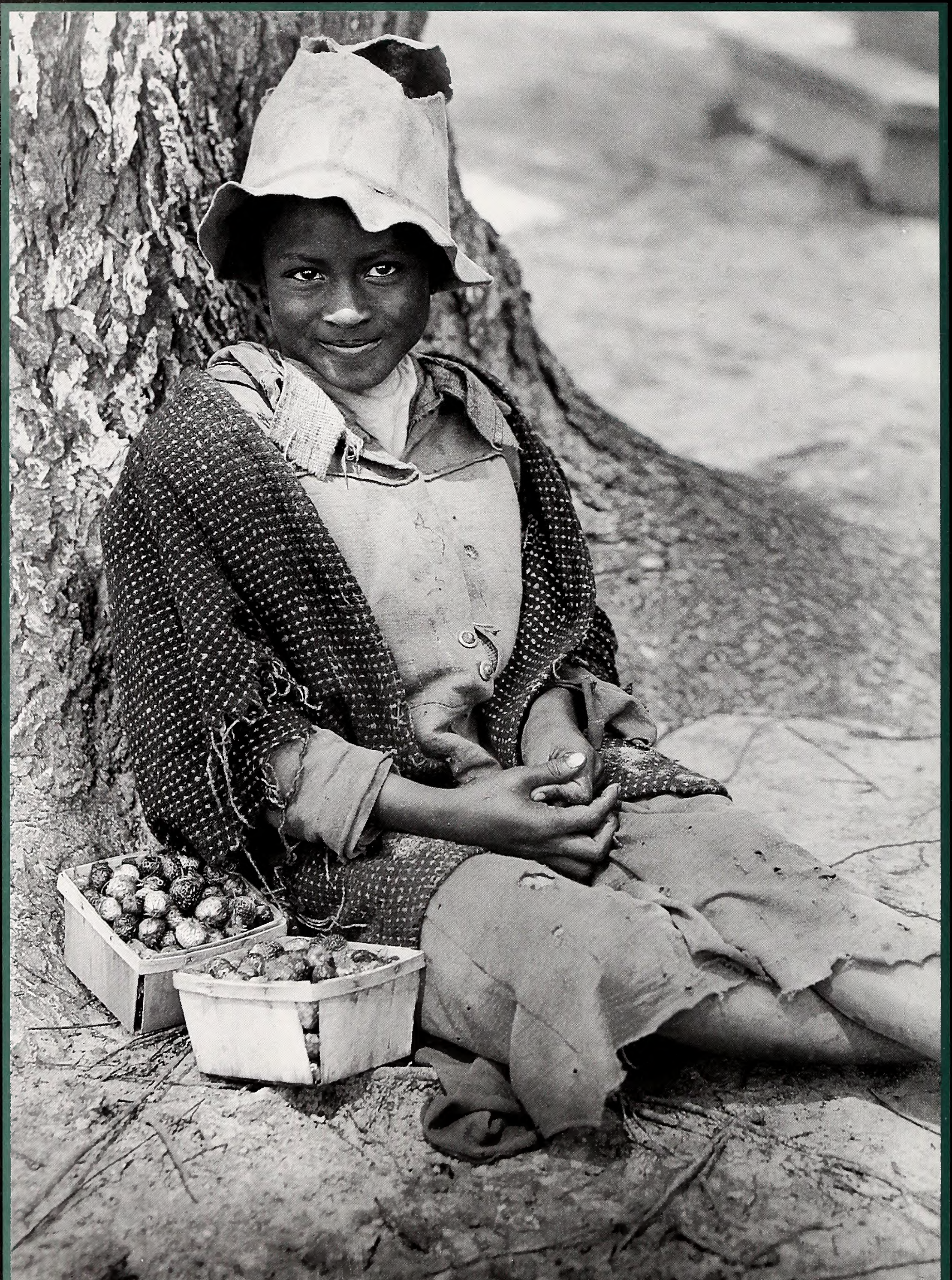
Many communities plan activities before or after the flotillas, which usually start at dusk or later. The following flotillas are scheduled this year, but other cities and towns have parades as well. • ***Topsail Island:*** Nov. 27 • ***Swansboro:*** Nov. 28 • ***Wrightsville Beach:*** Nov. 28 • ***Jacksonville:*** Dec. 5 • ***Morehead City & Beaufort:*** Dec. 5 • ***New Bern:*** Dec. 5 • ***Marine Corps Air Station:*** Dec. 6. For details, call the local chamber of commerce or city hall.



As many as 30 boats join the flotilla that files from Morehead City to Beaufort.







Though Bayard Wootten's photographs capture the poverty of the Great Depression, they also reveal the indomitable human spirit that rose above it. This girl was photographed in Chadbourn.

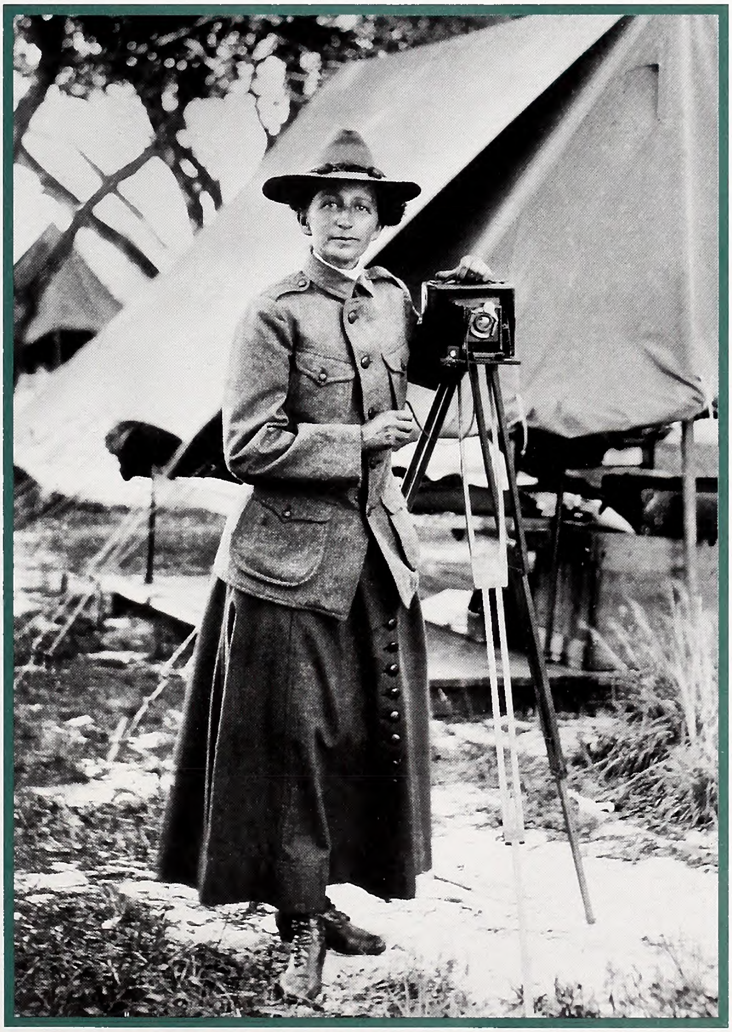
Light & Air

By David Cecelski • Photos courtesy of the North Carolina Collection at UNC-Chapel Hill

Bayard Wootten has long been one of my favorite photographers. Born in New Bern in 1875, she ran portrait studios in New Bern and Chapel Hill for nearly half a century. She was both a talented studio photographer and a gifted pictorialist with a fine artist's eye. She went anywhere, anytime, to get a good photograph. Camera in hand, she stayed for days in an Appalachian logging camp, flew in a Wright brothers' airplane and prowled the Croatan swamps.

Wootten's life and work are introduced to younger generations in *Light and Air: The Photography of Bayard Wootten*, a splendid new book by Jerry Cotten, the photographic archivist at UNC-Chapel Hill's North Carolina Collection. Cotten's book tells much about North Carolina earlier this century.

Light and Air focuses on Wootten's photographs of the Great Depression. They stand out in sharp contrast to the better-known pictures made by the photographers of the Farm Security Administration (FSA), a New Deal agency charged with documenting rural hardship. Full of pathos and hopelessness, the FSA photographs are the most enduring images of the 1930s. *Let Us Now Praise Famous Men*, by James Agee and Walker Evans, contains probably the best-known photographs of that ilk: stark images of hollow-eyed Alabama tenant farmers living dreary, poverty-stricken lives.



Photographer Bayard Wootten at work

FSA photographers such as Walker Evans and Dorothea Lange have had the most profound influence on American documentary photography this century. But while their photographs inspired pity, they rarely meant much to Southerners. This is not because people in the South failed to recognize the FSA's harsh images of the Depression. Rare was the rural Southern family that did not know poverty and privation in those years. Rather, few Southerners, black or white, agreed with the bleak, one-dimensional view of the human spirit portrayed in the FSA photographs.

Wootten saw a different South, though her photographs did not ignore the hardships of the Great Depression. She did not conceal ragged clothes, dilapidated homes or the gauntness of so many of the people she photographed. But my favorite of Wootten's photographs go far beyond social criticism — they depict a hard-pressed people mustering the grace and strength to survive the Great Depression.

Look, for instance, at the 1937 photograph of the girl taking a break from picking strawberries (opposite page). She was one of many seasonal

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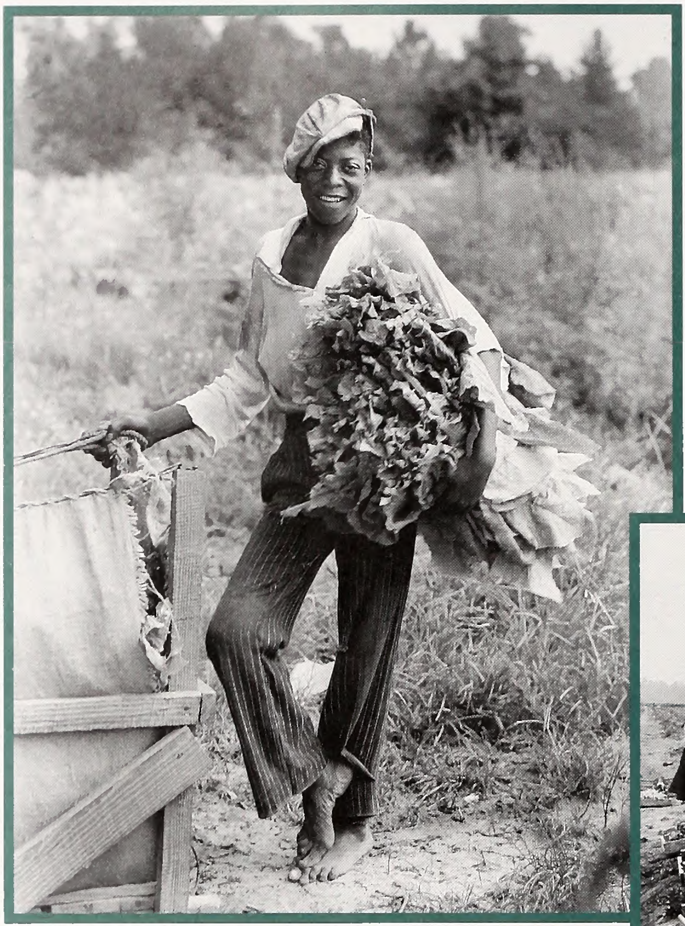


A North Carolina tobacco laborer

workers who traveled every spring to Chadbourn, in Columbus County, to labor in the strawberry fields. Though no longer the world's largest strawberry market, as it had been from 1895 to 1905, Chadbourn still attracted pickers from all over southeastern North Carolina.

To say that this photograph ignores the girl's plight because she looks so content — as many defenders of the FSA school of documentary photography might — misses Wootten's point entirely. In fact, you cannot miss the signs of the girl's hard life: her frayed dress full of holes, missing buttons, ragged shawl, work-worn hands. Wootten's home-state audience would also have known that, being in Chadbourn, the girl was from a family in the direst straits. But Wootten's photograph shows the girl's shining spirit rising above all that misfortune.

Loading tulips, Pinetown

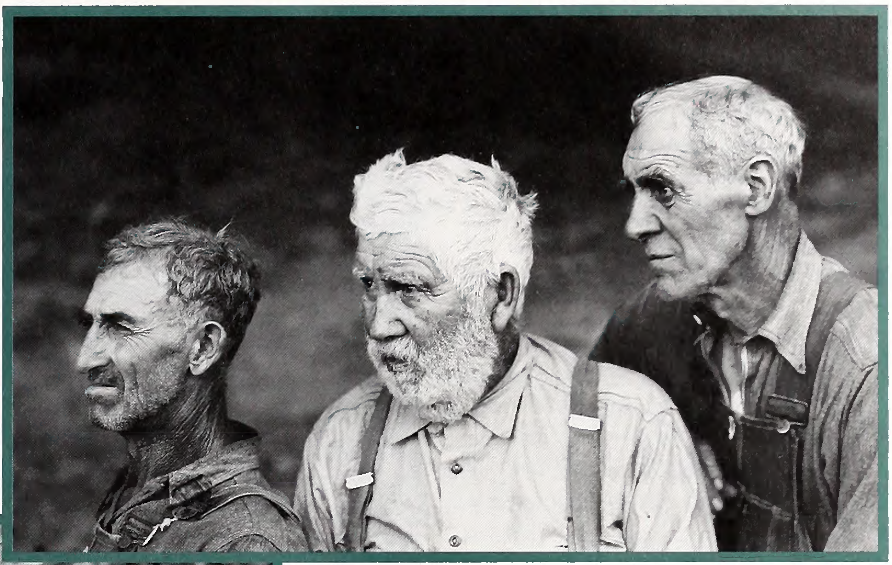
A fisherman mending nets, 1930s

Look, too, at the photograph of Ben Owen turning a pot in Jugtown, in Moore County, in the 1930s (page 21). For a century, craftsmen and women had been making pottery out of the central piedmont's crude red clay. They lived in a hard, unforgiving region of the state for farming, where the clay soil was more curse than boon. But potters like Owen took what little the land gave them — the clay — and created breathtakingly beautiful shapes and glazes. Wootten's genius was to catch Owen at just that moment when the plain and glorious seem one and the same.

Finally, look closely at the young black laborer standing in a tobacco field (page 20). You know he has worked in brutally hot, humid weather since sunrise. His fingers ache from cropping tobacco. The leaf nicotine stings his skin. His feet hurt. Notice, though, how he holds himself and wears his tattered trousers: He's the picture of verve and vim. Wootten has captured a strength of will that surpasses the limits of that tobacco field. Hard times will not hold this young fellow down.

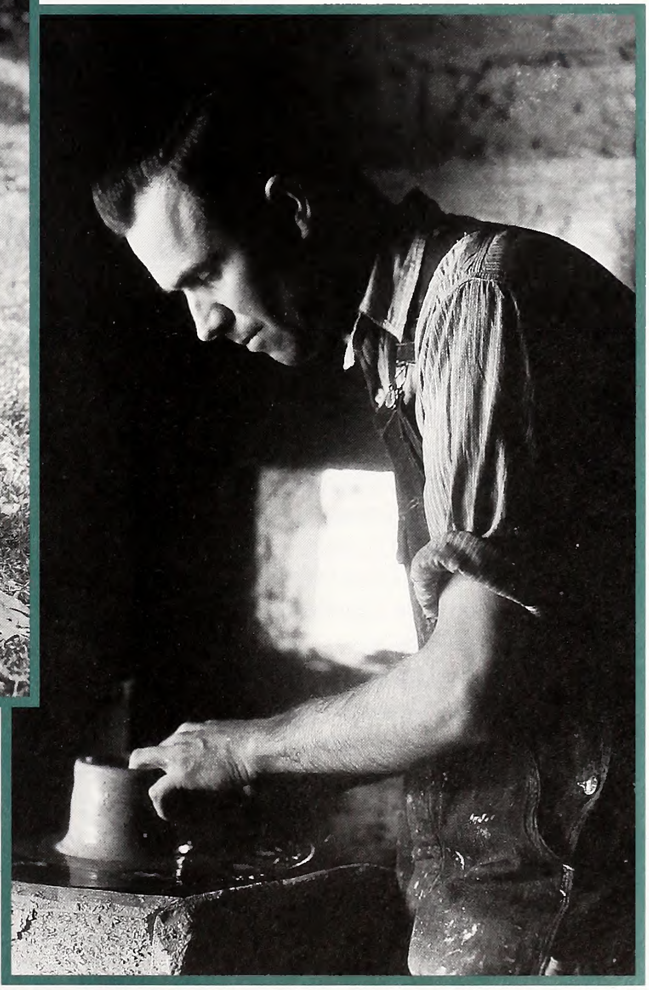
That's what Wootten was ultimately saying: We can rise above the Great Depression and even what author Robertson Davies once called that "underlying, deep grief of things." We can do it right here, in this place, out of our own hearts, with our own two hands. The FSA photographers never saw it, never believed we had it in us. They saw merely the hard red clay of Depression-era lives. Wootten saw how North Carolina people turned that clay into the human equivalent of Jugtown's pottery; that is, into lives of quiet grace and, sometimes, iridescent beauty. ◘

David Cecelski is a historian at the University of North Carolina-Chapel Hill's Southern Oral History Program and a regular columnist for Coastwatch.



Horse traders, Bryson City, 1930s

Mr. Hoppas fiddling, Penland



Ben Owen turning a pot, Jugtown

The Real Eel Deal

By Athena Osborne

It is not a snake. It is not a blood-sucking parasite. It is not poisonous, and it does not shock you with electric current. It is the American eel (*Anguilla rostrata*), an intriguing creature with a bit of an identity crisis.

Ancient Romans considered the eel a delicacy, early American settlers caught and farmed the eel, and today Europeans find its mild, meaty flavor delectable. But its virtues aren't merely culinary.

"Aside from their commercial importance, they are important as predators and scavengers in most aquatic systems," says Gene Helfman, associate professor at the University of Georgia Institute of Ecology.

So why are modern Americans so slow to acknowledge the worth and wonder of this delightful creature?

Martie Bouw, eel exporter and owner of Holland Seafood in Arapahoe, says his major market is still overseas, despite availability of eels in U.S. waters. Eel phobia sprouts from fear and misinformation, he says.

Indeed, the American eel often has been confused with more intimidating creatures: the snake, the lamprey eel, the electric eel, the moray eel and the conger eel.

Gene Helfman

Though these eels are at home in the water, they can also make brief detours over land when their routes are blocked.

This harmless fish does resemble the snake. Sleek, long and slender, it undulates through the water in a serpentine manner, trailing eddying Ss with its pointed tail. However, the resemblance ends there. The American eel is not a member of the snake class, *Reptilia*.

The eel is even less like the lamprey eel, a jawless, blood-sucking parasite of the Great Lakes. The American eel has a jaw. Like other members of the finned family, it preys on smaller creatures such as aquatic insects, worms, shellfish and an occasional clam or crab.

It is much smaller than the shocking electric eel of the Orinoco and Amazon basins, which is quite capable of electrocuting man or beast. And the moray and conger eels possess far larger and sharper teeth for stronger bites. The bite of the American eel is weak and nonpoisonous, lacking both the strength of jaw and length of tooth that would make it mightier.

"A very unusual creature," the American eel has dynamic characteristics unknown to most Americans, Bouw says. For example, the creature sports a fin, although a peculiar one. Unlike the distinct fins of many better-known fish, its fin is connected and continuous, gracefully curving around its pointed tail and gliding along its underbelly.

Scientists can pinpoint the eel's age based on the pigment changes that occur throughout its lifetime. For instance, as a

Gene Helfman

An eel's skin and thick epidermis protect it from changes in water salinity.

young larva, the eel has little or no pigmentation, is virtually transparent and is called a "glass eel."

When half-grown, it darkens to blackish-yellow and is called a "yellow eel." At adulthood, the burnished bronze fish is called a "silver eel."

The catadromous American eel migrates from fresh to salt waters to spawn, unlike the anadromous salmon. It is found from Iceland to Venezuela wherever rivers flow into the sea. Many scientists believe the eel's slick, slimy coating and thick epidermis provide double protection against the osmosis of toxic saline levels when it returns to salt water from fresh water. In its lifetime, an eel travels from the cool waters of the Sargasso Sea, located in the middle of the Atlantic Ocean, to the fresh inland waters of North America and then back again with no signs of toxicity.

Life for eels begins in the deep, dark heart of the Sargasso, which averages more than 3 miles deep. As tiny larvae, they hatch and begin to slowly ascend the water column. Gradually, the newborns join micro-plankton at the water's surface to ride the currents bound for land.

Only the fortunate eels survive this yearlong swim. Those that make it have yet another expedition ahead of them — a swim along freshwater rivers, canals and streams. Unlike the more acrobatic adult salmon, which can be seen leaping waterfalls on their upstream migration to spawn, young eels move deeply and silently, preferring cool, dark waters to warm, sunny ones.

Obstructions pose a challenge — but not a blockade — to creatures so forwardly inclined. In the evenings, when the eels prefer to move, they have been spotted scaling moist bridges or wet dams, even shimmying over dewy grasses to resume their journey on the other side.

This remarkable pioneer eventually makes its "home away from home" in cool lakes, ponds, tranquil reservoirs or estuaries where it remains and matures for up to 10 years. In these habitats, it begins to eat heavily, taking on a heavy mantle of flesh and fat as stored energy for a future journey.

Its mucus thickens, and its blood becomes toxic — systemic defenses that help boost resistance to starvation, asphyxiation and infections. Eventually, its digestive tract degenerates, and it ceases to feed.

From late August to mid-November, changes in the environment, such as higher water levels and dimmer light intensities, signal the eel to begin its last journey. It turns seaward to the Sargasso, where it will mate.

The events surrounding eel spawning are shrouded in mystery. Many scientists believe that adult eels die soon after spawning. Helfman agrees. "Female fishes that have spawned have very characteristic ovaries with a few leftover eggs," he says. "No eels have ever been found in that spent condition." Also, he adds, "large, ripe eels are found migrating out of rivers, but none have ever been found migrating back into rivers."

Perhaps the eels tire and sink to the ocean floor. Perhaps, in a defenseless state, they are eaten by predators. One thing is certain. As many as 15 million to 20 million eggs per female spill onto the waves, spiraling gently across them. Soon, in the warm sunlight of a prime, vernal season, the waves begin to pulse with the rhythm of the young. ◘

Celebrating Creativity at Pocosin Arts

By Julie Ann Powers

Photographs by Scott D. Taylor

Pocosin Arts spreads out in a hushed riot of color and texture on the second floor of an old brick building on Main Street in Columbia.

On the first floor below, washers whir and dryers hum in the local Laundromat.

The proximity to practicality is coincidental for the arts organization, but it nevertheless reinforces a message: Creativity is integral, and essential, to daily life. Pocosin Arts celebrates the particular creativity that arises from everyday existence in the surrounding woods and wetlands.

Feather Phillips founded Pocosin Arts four years ago.

The nonprofit center's mission is "connecting," explains executive director Feather Phillips, who founded Pocosin Arts four years ago.

The center took its name from the pocosin wetlands that dominate the landscape. "Pocosin" is an Algonquin word meaning "swamp on a hill." Bound by the Albemarle and Pamlico sounds, the region is one of awesome, untamed beauty. The human population, however, has a history of struggle with the elements and the isolation.

Pocosin Arts spotlights the resourcefulness of residents and the links between their lives and their surroundings. In an "education gallery," raw clay is situated next to exquisite pottery. Broom sedge bristles beside intricate Somerset baskets, replicas of those crafted by the enslaved population at the former rice plantation down the road.

"This gallery is to teach about the people, who they are, where they come from; to teach about the materials this environment produces and the cultural traditions, how they wrap around and are manifested in these materials," Phillips says.

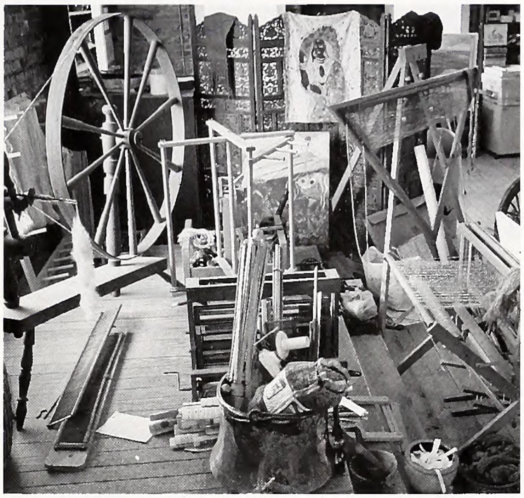
She grasps a twisted tree branch in one hand; in the other, she clutches an African walking stick, cut from similarly formed wood and topped with a delicately carved face.

"This is connecting culture to environment through art," she says.

Other displays reflect conservation habits that predate today's trends. Among the muted tones of an antique quilt, the words "100 Percent Pure Cane" reveal the patchwork was made from sugar sacks.

"One of the themes that runs through the collection is saving and piecing and recycling," Phillips says. "That's a cultural tradition here. Because of the poverty and the isolation, the people here didn't waste."

Pocosin Arts is no museum, however. The airy expanse beyond the gallery, where tall windows overlook the Scuppernong River, is a busy work space for artists and the setting for the center's many workshops. A gift shop beckons near the entrance. A potting studio unfolds along one wall. Spinning wheels, looms and bags of fleece — some from Phillips' own goats — line another. Everywhere, intriguing shapes and hues invite investigation.



Pocosin Arts work space

Roy Smith, broom-maker

Carol Lee at the potter's wheel

Retired farmer and forester Roy Smith gathers a heap of dried reeds from a table to make a "yard broom." Outside, he binds them with red calico, then slaps the leafy end on the walkway until only spikes remain. He remembers helping his mother make a broom like this to tidy the packed dirt yard of his childhood. He has captured the memory in bright paints on a wood block.

"Back then, a lot of people didn't have lawns," he says. "Most people had a lot of stock in the yard. Chickens and geese kept the grass down."

Placing such familiar items as yard brooms and quilts among finer arts is one reason Pocosin Arts is welcomed in a community that would seem to have little capacity for anything but survival. When the center opened, some local residents were surprised — and delighted — by the sudden attention to skills taken for granted and perhaps considered a mark of poverty.

"All I did was hold a mirror up and say, 'Look at yourself. Look how wonderful you are,'" Phillips says. "Our whole emphasis is not to force an aesthetic on this community or anybody else who comes here, but just to celebrate what's here and to encourage continuous creativity."

Fiber arts, pottery and folk arts are most visible at the center. But other forms — papermaking, wood carving, even welding — are honored.

Near the door, a lavender chair made of welded fuel tanks silently signals that Pocosin Arts is for everyone.

Continued

The center deliberately bought the whimsical chair to disarm any reluctance in its visitors toward art and artists.

"Anybody can identify with that chair," Phillips says, "especially local men who save scrap metal and weld. They saw immediately what that chair was made of, and they appreciated the humor and the skill."

Phillips hurries from one item to the next, eager to showcase the talents of the artists and the center's activities. A flowing sapphire dress sets off her silver hair and testifies to her own artistic flair. Feather seems a particularly fitting name, though she explains it is not an invention of her profession. Her first name is Kathryn, but she has been called Feather, short for her middle name of Featherstone, since childhood.

Pocosin Arts is the result of a confluence of several events in Phillips' life and the region she calls home. Before opening the center, Phillips taught art for seven years in nearby Creswell. The prevailing attitude among children reflected the area's economic situation.

"There wasn't a lot of confidence about where they lived, about who they were," she says.

Phillips, on the other hand, was enchanted by her surroundings and her neighbors. She left a public television career in Boston to live on Martha's Vineyard, then sailed south in 1972.

The boat docked in Wilmington, where she later married waterman Willy Phillips. They settled in Bath and had a son, Jake, now 14. But Willy Phillips couldn't make a living crabbing in the deteriorating waters in the Pamlico River. Attracted by the Alligator River and its still-productive waters, the family moved to Tyrrell County in 1987.

As the new art teacher in Creswell, Feather Phillips had an outsider's appreciation for the area and latitude in lesson planning. "So I decided to develop a curriculum that was based on this place and these people," she says.

Lee and Smith making a broom

In recent years, a regional effort to promote nature-based tourism began gaining momentum. Phillips wanted to make art a part of it.

"I felt that this fit," she says. "I was working with the children, and we were always gathering our own grasses and digging our own clay, or finding other materials to make art from the environment, and thereby having a better appreciation for the relationships, the connections. And I thought, well, maybe this would work for grown-ups too."

A personal epiphany propelled Pocosin Arts into being. Phillips was contemplating her 50th birthday in 1994. "I thought, you know, you have all these years and all these experiences and you have something you want to say. You're going to be 50, and you're not going to live forever. It's time," she recalls. She set to work on the grant proposal for the center's initial funding.

An environmental activist all her adult life, Phillips says Pocosin Arts is a change in tactics. She recounts displaying diseased fish at water quality hearings in recent times, protesting nuclear power in earlier years.

"We always were ranting against something," she says. "Instead of reacting against something, I decided to put forth a positive agenda that had the same goal. I felt that if this education program would encourage visitors and students and the community to appreciate the pocosin environment, to appreciate the human community, the whole package, then perhaps it would be less threatened. It would be just a little harder to say, 'Just fill it or dredge it.'"

The Z. Smith Reynolds Foundation granted $25,000 in the fall of 1994 to launch Pocosin Arts. After a flurry of work and renovation of its current quarters, Pocosin Arts premiered in October 1995.

Governed by a board of directors, it has flourished under other Reynolds money, grants from the Kathleen Price Bryan Family Fund, other organizations and the state, plus individual and business contributions. Its calendar is full of workshops and seminars. Remembering her own overextended teaching days, Phillips makes Pocosin Arts especially available to teachers.

The center features a pottery program taught by Carol Lee, who experiments with local clays. Lee shared the dreams and plans for the center with Phillips before the founding. She now shares a devotion to it.

"I never want to leave," Lee says.

An underlying philosophy of Pocosin Arts is that art could, at least in part, salve some of the region's woes. Nurturing creativity fosters success, Phillips says.

"It isn't just a pot or a carving or a painting or a weaving," she says. "It's 'I did it. I *can* do it again. Or maybe I *can* do something else.'"

Art, she says, also can bring diverse groups and cultures together.

"People can communicate through art who might not be able to otherwise," she says. "Different cultures can communicate. I saw it with children."

And she believes the capacity to create is universal, a common thread connecting all. "It's part of the human package, creativity," she says.

Her own creation, Pocosin Arts, has reached far beyond her personal dreams for it. "It belongs to other people now," she says.

Pocosin Arts is raising funds to buy the building it shares with the laundry, and another one next door, so it can expand. Meanwhile, Phillips is dreaming new dreams for connecting culture to the environment through art.

"It's limitless," she says, "how this creative setting can be used." ◘

Pocosin Arts is at the corner of Water and Main streets in Columbia. The center is open Tuesday through Saturday from 10 a.m. to 5 p.m. Call 252/796-2787.

Book Some Time
with the North Carolina Coast

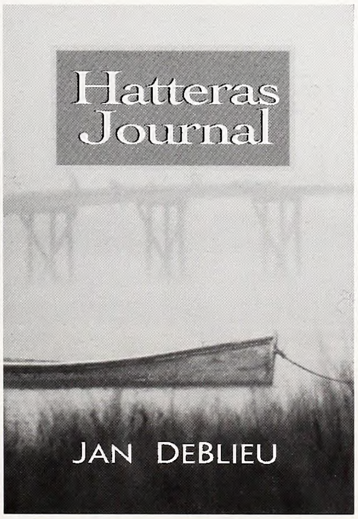
By Daun Daemon

The holidays offer a time to reflect and relax — if you can get away from the bustling shopping malls and festive events. And while giving to others is an important and gratifying part of the holiday season, giving to ourselves is also important.

This year, treat yourself. Set aside time to fall into your favorite reading chair and crack open a book about the Carolina coast.

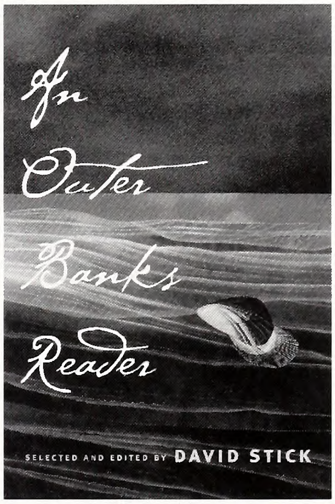
- **Hatteras Journal** *by Jan DeBlieu. 1998. John F. Blair, Publisher, 1406 Plaza Dr., Winston-Salem, NC 27103. 232 pages. Paperback, $12.95. ISBN 0-89587-214-5.*

If you read this book when it first was published 11 years ago, then here's your chance to share it with others who love nature in general or North Carolina's coast in particular. Originally published in hardcover in 1987, this chronicle of Outer Banks life is now in paperback in Blair's Salem Selections series.



DeBlieu is a master at rendering natural history and ecology in the written word. She has contributed to *Audubon, Smithsonian* and many other national magazines. Her latest book, *Wind*, was published in July.

Hatteras Journal is a collection of 10 essays arranged chronologically. Beginning with a legendary nor'easter that raked over Hatteras Island in 1986, DeBlieu moves through her first year or so on the island with grace and drama.



Her chapter on loggerhead turtles is as luminous as the experience of watching a turtle nesting. It's a mesmerizing account with all the elements of human drama. Will the eggs hatch? If they do, will the hatchlings reach the surf, avoiding the clutches of ravenous raccoons? Once in the ocean, will they survive to find shelter in the Sargasso Sea? This drama is told in language that is often sublime: "We crouched in back of the turtle. Pure white barnacles that glistened with phosphorescence were strung down her shell like strands of pearls."

The chapters on fishing — commercial trout fishing and recreational red drum fishing — are detailed to the point of intimacy. DeBlieu reveals a world that many of us don't appreciate or that we take for granted. Fishing, for those of us who are not enthusiasts or who never question whence comes our seafood dinners, is not just nets and fishing lines, monofilament and bait — it's sweat, exhaustion, soggy clothes and exultation. Most landlubbers cannot imagine that a ride in a trawler and a night on the beach with a legion of surf fishers would be enlightening and even thrilling, but they apparently were for DeBlieu — and for the reader through her words.

Throughout this book on nature, we meet the people who act as caretakers for her denizens and resources, who are affected by her furious storms, who reap rewards from her bounty, who sit in awe of her beauty. The best thing this book does is remind us that the North Carolina coast has an unrivaled personality and spirit.

- ***An Outer Banks Reader**, edited by David Stick. 1998. University of North Carolina Press, P.O. Box 2288, Chapel Hill, NC 27515. 317 pages. Paperback, $16.95. ISBN 0-8078-4726-7.*

Some might argue that no one else knows the history and culture of the Outer Banks as well as Stick, often called "Mr. Outer Banks." Having lived on or near these barrier islands for most of his years, Stick has spent decades writing about life there. His earlier books *Graveyard of the Atlantic* (1952) and *The Outer Banks of North Carolina, 1584-1958* (1958) are still in print, as is his *Roanoke Island:*

Continued

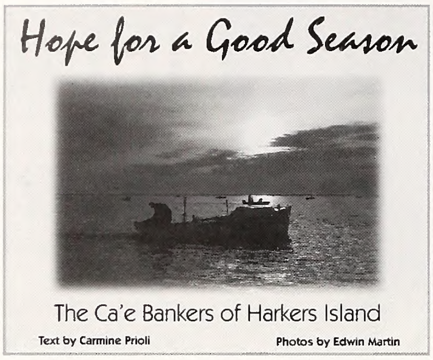
The Beginnings of English America, published in 1983.

His latest book covers an array of topics from the early days of life on the Outer Banks to its natural history to memorable Bankers and others who passed through. The 64 selections span the centuries from 1524 to 1995, giving a sweeping perspective on the changes that man has wrought on these fragile islands.

Stick says in his introduction, "*An Outer Banks Reader* is ... the culmination of a four-year search through more than a thousand books, pamphlets, periodicals, historical documents and other writings, seeking the ones that seemed to add color to this verbal picture of the Outer Banks." Later he adds, "Together they form a potpourri, covering more than four and a half centuries of observation."

Beginning with Giovanni da Verrazano's first-person account of how Outer Banks natives rescued a sailor from rough surf, treated him kindly and then sent him safely back to his ship, the tone for the rest of Stick's choices is set: true stories and honest views of the people, places and events that have shaped the area. Between the covers, you will find tales of shipwrecks and pirates, mysteries and oddities. You'll go fishing, fight battles and relive the Wright brothers' first flight. By the time you turn the last of these 297 pages, you will have gone on a wild and wonderful ride through Outer Banks history. These are stories you will turn to again and again for entertainment and a perspective on our past.

All royalties from sales of the book will go to the Outer Banks Community Foundation's Frank Stick Memorial Fund, which provides support for the Outer Banks History Center.



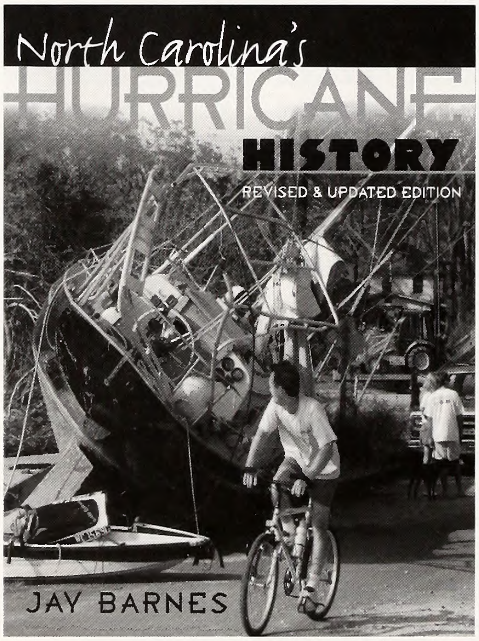
• ***Hope for a Good Season: The Ca'e Bankers of Harkers Island*** *by Carmine Prioli. Photographs by Edwin Martin. 1998. Down Home Press, P.O. Box 4126, Asheboro, NC 27204. 119 pages. Paperback, $15.95. ISBN 1-878086-65-0.*

In his somewhat nostalgic text, Prioli, a literature and folklore scholar, offers a careful investigation of events and ways of life rather than an emotional appeal for preserving the Harkers Island culture. The "Ca'e Bankers" of the title is a local term for people who have lived for generations at Cape Lookout and Shackleford Banks. "Hope for a good season" is the perennial sentiment of the fishers who increasingly find their livelihoods challenged by development, competition and declining stocks of fish and shellfish.

Prioli begins his study with a concise look at the settlement history of the area. From there he progresses to a number of subjects, some prickly, such as the culling of the wild pony herds on Shackleford Banks. Prioli explains the importance of a 1953 hurricane that opened Barden Inlet and the bridges that allowed easy access for mainlanders who changed island life forever. He ends with a bit of fun: a glossary of Harkers Island vocabulary, the unique brogue spoken on the island. Side stories cover a number of interesting points of island life and lore, from decoy carving to boatbuilding to the legend of the fully laden rumrunner that ran aground in 1923.

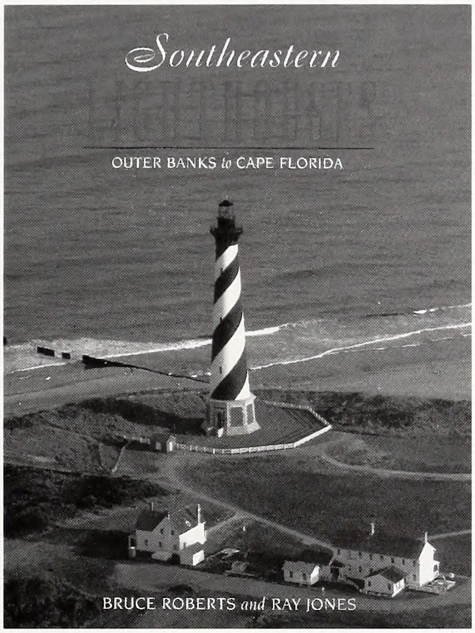
An interesting element of this book is that the text is separated from most of the 60 or so photographs, which are often haunting in their smoky representations of the islanders. A handful of images punctuate the narrative, but most are reserved for a gallery in the second half of the book. The effect is often unsettling, as if these disjointed images are floating free from one another, avoiding coalescing into a coherent whole. Yet this effect is apt, for it reflects the fragmentation of island life that has occurred in these past decades.

Overall, the book presents a brief yet potent glimpse into a disappearing culture. And Prioli is careful not to pass judgment on this evolution. His point, as sharp and piercing as the call of a gull, is clear in the words he allows the Ca'e Bankers to speak: Until the day they die, these people will cling to their way of life, hoping for a good season.



• ***North Carolina's Hurricane History*** *by Jay Barnes. Revised and updated edition. 1998. University of North Carolina Press, P.O. Box 2288, Chapel Hill, NC 27515. 256 pages. Paperback, $18.95. Hardcover, $34.95. ISBN 0-8078-4728-3.*

Hazel. Hugo. Fran. These are names most North Carolinians will never forget. And while our memories of lesser storms may fade, the likes of Donna, Connie and others that raged unnamed in decades and centuries past have left their marks as well. This point is clear in Barnes' examination of the Tar Heel state's hurricanes.



First published in 1995, the book now offers 33 pages of photographs and information on Fran as well as a section on Bertha. And though it is packed with information, this chronicle of the state's storms is no almanac of dry facts. It examines the lives and communities affected by hurricanes and the growth that makes them more economically devastating.

With more than 200 maps, illustrations and photographs, the book's visual content is as effective as its text. Maps of the hurricanes' paths are riveting, leading readers to think of familiar places, visits to areas once devastated, people they know living there still.

The photography is as relentless as the constant waves that overwash islands in the storms. With the turn of almost every page comes another picture of destruction, flooding or the indomitable spirit of the people caught in the midst of the disaster. In black and white, the images chronicle a history of change and cycles, suffering and survival.

Appendices list the most destructive, strongest and deadliest hurricanes in the country's history. This puts recent hurricanes into perspective, for while they have been financially devastating, the greatest loss of life happened before hurricanes were given names. If the storm of 1900 that killed more than 8,000 people in Galveston, Texas, hit today's widely developed shores at, say, Wilmington, the loss of life might rival that of the Asian cyclones that kill tens of thousands.

Included are stories of residents who miraculously rode out storms or those who did not hear the warnings and fought ingeniously to stay alive, of townspeople pulling together in the aftermath of devastation, of rescue workers who risked their lives to help people in danger. Though Barnes tells these human stories of the hurricanes clearly, without melodrama, the careful cataloging of details creates an intense and emotional narrative.

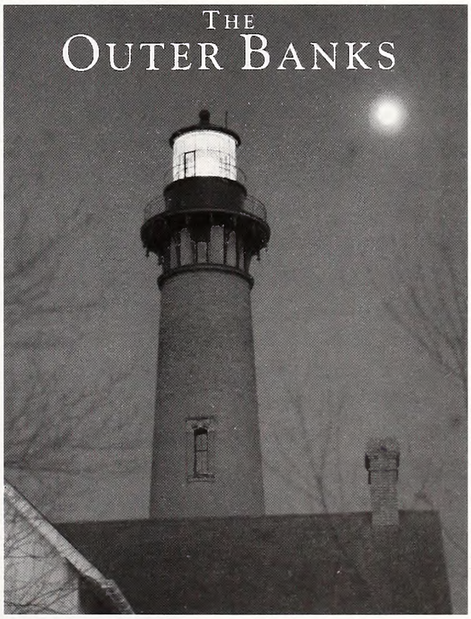
ALSO WORTH MENTIONING ...

If you admire Bruce Roberts' sparkling photography, then these two glossy, large-format paperbacks should strike your fancy. Though both contain photos from archives and by other photographers, Roberts' signature style dominates.

- ***Southeastern Lighthouses: Outer Banks to Florida*** *by Bruce Roberts and Ray Jones. 1998. The Globe Pequot Press, P.O. Box 833, Old Saybrook, CT 06475. 92 pages. Paperback, $19.95. ISBN 0-7627-0217-6.*

Now in its third printing, this book showcases stunning shots of North Carolina's lighthouses as well as those in South Carolina, Georgia and Florida. Because this book can be used as a travel guide, directions to each lighthouse are included. These sentinels by the sea are more than mere structures, and the authors make this point by touching on the historical, cultural and architectural importance of lighthouses. They also enthrall with stories of pirates and shipwrecks, relentless storms and raging wars, heroism and love, and even a ghost story.

- ***The Outer Banks*** *by Bill Yenne. 1998. The Globe Pequot Press, P.O. Box 833, Old Saybrook, CT 06475. 48 pages. Paperback, $14.95. ISBN 0-7627-0384-9.*



This slim volume is a perfect keepsake to remind folks of their trips to one of the country's most unique coastal regions. Large color photos are paired with a few paragraphs of informative text. The pictorial tour of the Outer Banks stops at the Elizabethan Gardens, Duck, Cape Lookout, Ocracoke Island and many other notable locations. ▫

Untangling the Facts about Knots & Line

By Renée Wolcott Shannon

Lots of kids fish in their back yards before they ever see the ocean. All they need is a fallen twig and a length of kitchen string, and they're set. The only knot they know is the one they use to tie their shoes. But given the breadth of a child's imagination, that simple "rod and tackle" can land a whale.

Things aren't as simple for the serious fisher. Today's market offers a broad selection of monofilament lines, and the smart angler will know the best knots to prevent "the big one" from getting away.

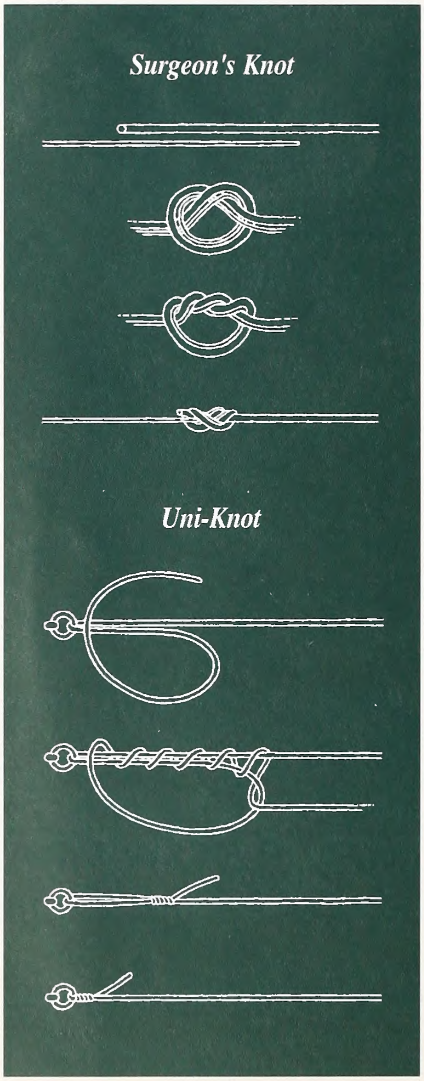
"You never know what's going to take your bait," says Jim Bahen, a Sea Grant fisheries agent. "It could be a pinfish or crab, or it could be an award-winning 7-pound speckled trout. Something big could take off with your hook and — bing! — break the line."

To lessen the chances of this mishap, it's best not to skimp when selecting line and tying knots.

Buying premium monofilament instead of a cheaper line will likely save money over time, Bahen says. Cheap line is more likely to abrade and break, costing both line and fish. For a few dollars more, you get a stronger line with characteristics to match your fishing style. Toothy fish such as speckled trout require a line with higher abrasion and tensile strength, while easy casting demands a limp line with good elasticity.

Of course, you should always buy line with the proper pound-test for the fish you hope to catch. Pound-test refers to the line's strength, or how many pounds of force can pull against the line before it breaks. For surf fishing, where fish rarely top 25 pounds, Bahen recommends a 6- to 20-pound line. Offshore fishing requires heavier line, usually 30 to 100 pounds.

New developments for specialty fishing include super polymer lines, like DuPont's Kevlar line and Allied Chemical's Spectra line, which are very tough and do not stretch. They also cost much more than regular monofilament. If you decide to experiment with such "unbreakable" lines, Bahen cautions, your knots are more likely to slip or come untied.



You may also want to try colored line. "Colored lines can help surf fishers or nighttime anglers who need to know exactly where their lines are and whether they need to take up any slack," says Bahen.

Improved visibility is helpful when trolling with multiple lines in the water, enabling you to get to the correct line quickly. Common colors include blue, gold and fluorescent green. Colors disappear in the water, though the line itself is still slightly visible. A new development called fluorocarbon line, a more expensive option, is colorless and completely invisible underwater.

Once you've chosen a line, it's time to tie it to your gear. Winter is an opportune time to replace the lines from last season. Exposure to salt and sunlight breaks down monofilament, reducing its strength. Lines also chafe against gear, pilings and the fish you catch, weakening further. Test used line by tying a simple overhand knot about 10 inches from the tag end, wrapping the line on either side of the knot around your hands and pulling. You may want to wear gloves. If the line breaks easily, replace it. Move up the line toward the reel until you find stronger line and cut off the weak section.

When securing new line to the reel, remember that it has "memory" of the spool it has been wound around; wind it onto the reel carefully so it doesn't twist. Bahen describes a good way to do this with the help of a friend: Insert a pencil through the supply spool with the end of the line coming over the top of the spool. While your friend holds the ends of the pencil, gradually wind the line off the spool and onto the reel, keeping slight pressure on it with your fingers. If you can't find a friend, wind the line from the spool while it sits label-up on the floor. Both methods should prevent your line from twisting and tangling, but check periodically to be sure.

If replacing only part of your line, a surgeon's knot is one of the best ways to connect the old and new lines. This knot is also good for joining lines of different diameters, such as a line and leader.

To form the surgeon's knot, lay the two lines parallel to each other, overlapping by at least 6 inches. Treating the two lines like a single one, tie an overhand knot in them, pulling the new line all the way through the loop. Now make one more turn through the loop with the doubled lines, once again pulling the new line through. Hold both lines and both tag ends and pull the knot tight, then clip tag ends close to the knot.

One tip to remember — wet the line before pulling the knot tight, says Bahen. This reduces friction and prevents weakening around the knot. An easy way to wet your line is to run it through your mouth before tightening.

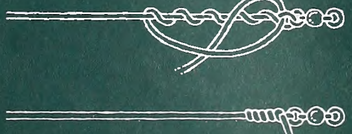
Using the correct knot for your particular kind of terminal tackle, whether you use a lure, spoon or bait, ensures both line strength and the natural movement of the bait or lure in the water. "Fishers often neglect the most important part of the tackle: the part closest to the fish," Bahen says.

He recommends the uni-knot when connecting your line to a lure such as a MirrOlure, since the uni-knot loop allows for a lot of action and natural movement through the water. Run the line through the eye of the hook or lure at least 6 inches and double it back so it is parallel to the standing line. Bend the tag end back toward the lure, crossing over the doubled line. Make six turns around the doubled line and then pass the tag end through the large loop. Hold the double line where it passes through the eye and pull the tag end to snug the knot. When the fish strikes, the knot will slide down against the eye. This multipurpose knot is also good for connecting line to your reel.

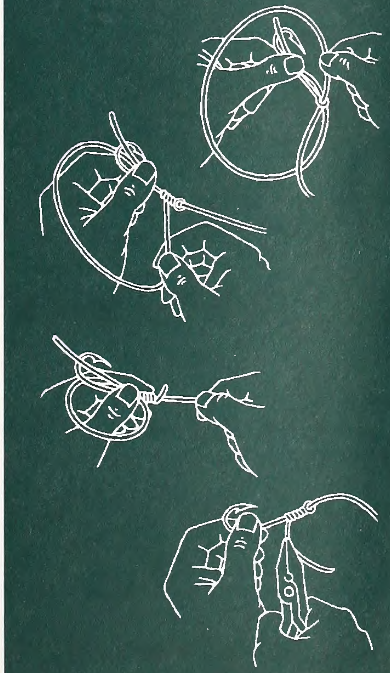
Bahen recommends the common clinch or improved clinch knots for attaching line to terminal tackle.

For the improved clinch knot, pass the end of the line through the eye of the hook, swivel or lure. Double the line back on itself and wind the tag end around the standing portion five times. Holding the coils in place, thread the tag end through the first loop, just above the eye. Now pass the tag end back through the big loop. While holding the standing line and the tag end, cinch down the coils until they make a smooth spiral against the eye of the hook or lure (the hitches should not overlap). Clip the tag end close to the knot. This knot is excellent for lighter pound-test line: 2 to 20 pounds.

Improved Clinch Knot



Snelling a Hook



For heavy pound-test line, up to 100 pounds, use the regular clinch knot. Follow the same steps for the improved clinch, but after passing the tag end through the loop just above the eye, do not pass it back through the big loop before pulling tight. For even stronger knots, double the line.

When using bait, you may attach a hook to your line by "snelling," which makes a strong, smooth connection to the line. Look for hooks with eyes bent at an angle to the shank or straight part of the hook.

To snell the hook, insert the tag end of the line through the eye to a length just longer than the hook itself. Holding the tag end against the shank, feed the standing end of the line through the eye in the other direction, creating a large loop. Holding the tag end and the upper section of the loop snug against the shank of the hook, use the lower section of the loop to wind tight coils around the shank, moving from the eye toward the hook. Make five to 10 turns as appropriate for the length and strength you need. Move your fingers to hold the coils tightly in place, and then pull the standing end of the line until the entire loop disappears under the coils. Use pliers to pull the tag end and cinch down the snell. Clip off the tag end.

You need a variety of knots in your repertoire. For more information on lines and knots, including complicated yet practical knots like the Bimini twist, visit a tackle shop for a guidebook. Impress your friends with the Albright special or the offshore swivel. You may get so hooked on knots, you'll take up macramé.

MARITIME
MORSELS

Winter Warm-Ups

By Joyce Taylor

When we think of cold weather comfort, steamy foods come to mind. Something about gray days and early dusk makes us hungry for hot, tasty food to warm us up. Seafood fits the bill.

Seafood soups, stews, chowders and gumbos are soothing and satisfying and can be a meal by themselves. And some hearty dishes can be made in a short time.

To create your own tasty seafood soup, start by sautéing some onions, celery and garlic in a large pot. Add a can of quality chicken broth and a can of chopped tomatoes. Season to taste with your favorite herbs and spices. When these have heated and blended at least 20 minutes, add your seafood and simmer just until the fish or shellfish is done. Remember, seafood cooks quickly. Cook only until slightly opaque — it will continue to cook as it stands in the hot broth. Overcooking makes seafood dry and tough.

Lean, firm white fish are best for soups. Delicate, fatter fish will fall apart. Grouper and catfish are ideal. Medium-firm fish such as black sea bass, snapper, large flounder and spotted sea trout are equally good. Shrimp, clams, oysters and scallops all are great in soups.

Other hearty seafood meals are also easy and fun.

Try a shellfish boil. In a large pot, bring water and seasonings to a boil. You can find many prepared seasoning or "crab boil" packets in grocery stores or seafood markets. Or make your own, using your favorite spices and herbs.

When the mixture is boiling rapidly, add small potatoes and boil until almost done, about 20 minutes. Add frozen corn-on-the-cob. Continue boiling, then add shrimp (in the shell) and cook until done. Drain, turn out on big platters, and dinner is ready. Serve with melted butter. You can also use clams, oysters or scallops; just be sure not to let them boil and become tough.

If pasta is the dish of the day, sauté some shrimp or other shellfish and add to the pasta, along with sauce or freshly grated cheese.

Or make your own delicious meal with fish. Brush fillets with melted butter and sprinkle with salt, freshly ground black pepper and paprika (or your choice of seasonings). Broil until done, skin side down, about 4 inches from heat source. A simple — yet special — entrée.

In coastal North Carolina, winter has long been associated with oyster roasts. The winter months bring plump, juicy oysters, and staying out in the cold while they cook over a big fire is a treat in itself.

You can also bring shellfish feasts inside. Bake, steam, broil or fry oysters, or use them in soup, stew or chowder.

If you're feeling adventurous, try an indoor clambake, where everyone gets a full meal of clams, chicken, potatoes, carrots and onions. Or steam clams in the shell. And winter is always a good time for a satisfying clam chowder.

From elegant dinners to simple fish and shellfish cooked with just a few ingredients, seafood is the perfect winter food.

Fisher's Stew

This is a warm, tangy soup filled with fish and vegetables. A crusty bread completes the meal. Little chunks of corn-on-the-cob make it especially pretty.

- 2 pounds firm, skinless fillets, cut in 1-inch cubes
- 2 tablespoons margarine
- 1 cup chopped onion
- 1/2 teaspoon pressed garlic
- 2 cans tomatoes, undrained and chopped
- 3 cups water
- 1 teaspoon dried basil leaves
- 1 teaspoon dried thyme leaves
- 1/4 teaspoon crushed red pepper
- 1 teaspoon salt
- 4 cups winter squash, cut in 1-inch cubes
- 2 ears corn, cut crosswise in 1-inch pieces

Melt margarine in large saucepan over medium heat. Add onion and garlic and cook until tender. Add tomatoes, water, basil, thyme, red pepper, salt, squash and corn. Cover and bring to a boil. Reduce heat and simmer until squash and corn are done, about 10 to 15 minutes. Add fish and continue to cook until it flakes easily with a fork, about 10 minutes. Serves 10 to 12.

Golden Broiled Flounder Fillets

Quick and easy to prepare, this delicious "fast food" is healthy and nutritious.

- 6 medium flounder (or other) fillets
- 4 tablespoons margarine, melted
- 1 tablespoon grated onion
- 2 tablespoons fresh lemon juice
- 1 teaspoon salt
- 1/8 teaspoon freshly ground black pepper
- 1/4 teaspoon dried thyme leaves
- paprika
- lemon wedges (optional)

In small bowl, combine margarine, onion, lemon juice, salt, pepper and thyme. Place fillets on greased broiler rack, skin side down. Baste with margarine mixture. Broil about 4 inches from heat until done, about 8 to 10 minutes, basting and sprinkling with paprika after first 5 minutes. Garnish with lemon wedges. Serves 6.

Baked Oysters with Fine Herbs

Fresh green onions and parsley add a touch of summer to this dish.

- 3 dozen select oysters
- 1/4 pound margarine, softened
- 3/4 cup green onions, including tops, finely chopped
- 1/4 cup finely chopped fresh parsley
- 1/4 cup finely chopped fresh tarragon (or 4 teaspoons dried)
- 1/4 cup fresh cracker crumbs
- 2 teaspoons fresh lemon juice
- rock salt

Scrub oysters thoroughly with stiff brush under cold, running water.

Shuck oysters and place the deep half of the shells level on a bed of rock salt on baking pan. Mix margarine, onions, parsley, tarragon, crumbs and lemon juice. Divide evenly over oysters. Broil about 4 inches from heat until desired doneness, 3 to 8 minutes. Serves 6.

Steamed Clams in Wine Broth

Fragrant bowls of clams and broth warm both body and heart.

- 36 small clams in the shell
- 1/2 cup dry white wine
- 2 tablespoons butter or margarine
- 6 tablespoons butter or margarine, melted
- lemon wedges (optional)

Scrub clams thoroughly with stiff brush under cold, running water. Using a large pot with rack or steamer, place wine and 2 tablespoons butter in bottom of pot. Place rack in pot. Arrange clams on rack. Cover. Place over high heat and bring to boil. Reduce heat and steam for 6 to 10 minutes or until clams open. Arrange clams in their shells in shallow soup bowls and pour steaming broth over them. Add 1 tablespoon melted butter to each bowl. Serve with lemon wedges. Serves 6.

Scallop Bisque

A delightful, rich soup. If you're not concerned about fat or calories, use half-and-half instead of milk.

- 1 pound scallops
- 4 ounces fresh mushrooms, sliced
- 5 tablespoons margarine
- 1/2 teaspoon dry mustard
- 1 teaspoon salt
- 1/4 teaspoon freshly ground white pepper
- 4 tablespoons flour
- 1 quart milk
- paprika

In large saucepan, lightly sauté mushrooms in 1 tablespoon margarine over medium heat. Remove mushrooms. Purée mushrooms and scallops.

Melt remaining margarine. Add purée, mustard, salt and pepper. Cook 5 minutes, stirring occasionally. Blend in flour. Add milk gradually, stirring constantly, and cook until thick. Place in soup bowls and sprinkle with paprika. Serves 6.

ADVICE FOR THE CHEF

When cooking seafood, you don't always have to use the species named in a recipe. It's best to shop for fresh fish, not always a particular species.

When you substitute, try to interchange fish that are similar in flavor, texture and fat content. For example, substitute a lean fish for another lean fish, one delicate flavor for another.

Always use fresh ingredients in your recipes. There is a world of difference in a seafood dish made with fresh lemon or lime juice rather than bottled juice. Garlic powder is no substitute for fresh garlic. And dehydrated onion does not impart the sweet flavor of fresh onion.

If a recipe calls for canned mushrooms, use fresh ones instead. Slice and sauté them in margarine, drain and use them the same as canned.

And once you grate your own cheeses, you'll never want to buy packaged grated cheese again, whether cheddar, Parmesan or another type.

Use fresh herbs. Fresh parsley in *Baked Oysters with Fine Herbs* adds a flavor that dried parsley can't match.

If you ever grind your own black or white pepper, you'll never buy another box of ground pepper. If you don't have a good pepper mill, treat yourself to one. It's a must in food preparation.

SOME SPECIES OF FISH CAN BE INTERCHANGED IN RECIPES

- Lean fish with delicate flavor: flounder, catfish, snapper
- Fish with a fine texture: flounder, snapper, sea bass
- Fish with a firm texture: catfish, shark, grouper
- Oily fish with a moderate flavor and fine texture: bluefish and Spanish mackerel

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